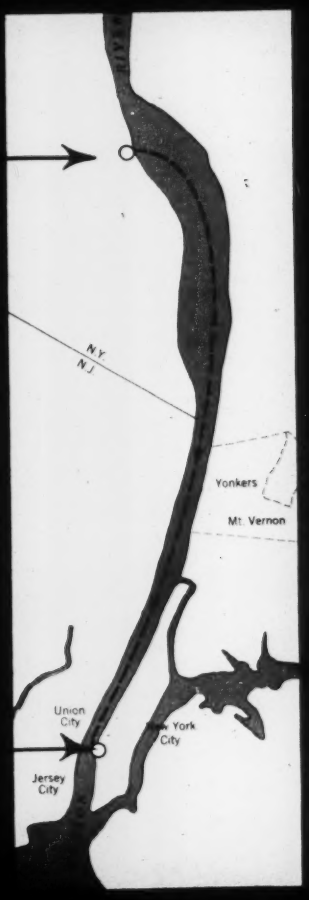
CIVIL ENGINEERING

MARCH 1952

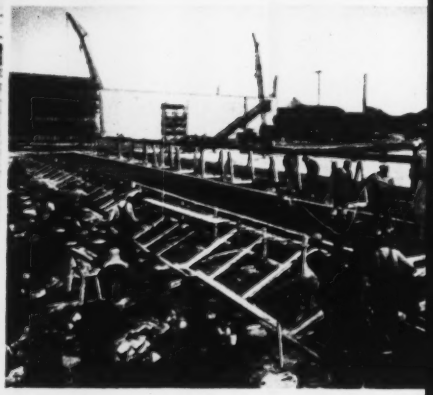
THE MAGAZINE OF ENGINEERED CONSTRUCTION



ORE DOCK

GREAT LAKES STEEL CORPORATION

ZUG ISLAND MICHIGAN



FIFTY Raymond CONTRACTS

FOR GREAT LAKES STEEL CORPORATION

DIVISION OF NATIONAL STEEL CORPORATION

The construction of the Ore Dock was the 50th contract between Great Lakes Steel Corporation and Raymond Concrete Pile Company. The work involved the placing of approximately 36,000 cu. yds. of concrete on 7100 long pipe step-taper piles.

WE ARE EXTREMELY PROUD OF THIS RECORD OF SERVICE TO THE GREAT LAKES STEEL CORPORATION

BRANCH OFFICES in the principal cities of the United States and Central and South America.

Raymond CONCRETE PILE CO.

140 CEDAR STREET • NEW YORK 6, N. Y.

SCOPE OF RAYMOND'S ACTIVITIES Soil investigations, pile and caisson foundations, underpinning, harbor and river improvements and the lining of steel and concrete pipelines by the Centriline process.

Savings for you— All down the Air Line

START YOUR SAVINGS WITH A GARDNER-DENVER WATER-COOLED PORTABLE

You can bank on a Gardner-Denver Two-Stage, *fully* Water-Cooled Portable Compressor for low-cost compressed air that's always available at full capacity — regardless of temperature, weather or altitude.

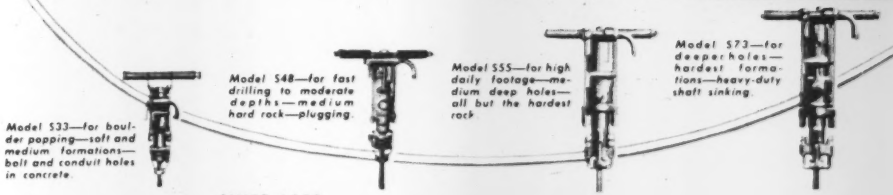
ADD AN LO12 AUTOMATIC LINE OILER

Saves shop time and repair costs for any pneumatic tool, because it's designed to stop the flow of air when it runs out of oil. Protects your drills and tools against "dry run" damage.

TOTAL UP THE EXTRA FOOTAGE DRILLED WITH GARDNER-DENVER SINKERS

Pick the size that's correct for deep or shallow holes — in any type of ground — and watch your drillers turn in more footage every shift. Powerful rotation — excellent hole cleaning ability — easy holding characteristics.

Write us today for further information on saving with Gardner-Denver Portables, Line Oilers and Sinkers.



Model S33—for boulder popping—soft and medium formations—bolt and conduit holes in concrete.

Model S48—for fast drilling to moderate depths—medium hard rock—plugging.

Model S55—for high daily footage—medium deep holes—all but the hardest rock.

Model S73—for deeper holes—hardest formations—heavy-duty shaft sinking.

SINCE 1859

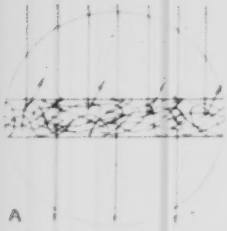
GARDNER-DENVER

Gardner-Denver Company, Quincy, Illinois
In Canada: Gardner-Denver Company (Canada), Ltd., Toronto, Ontario

CIVIL ENGINEERING, The Magazine of Engineered Construction, March, 1952. Vol. 22, No. 3. Published monthly by the American Society of Civil Engineers. Publication office 20th and Northampton Streets, Easton, Pa. Editorial and advertising departments at the headquarters of the Society, 33 West 39th Street, New York, N. Y. Price $.60 a copy, $5.00 a year in advance, $4.00 a year to members and to libraries and $2.50 a year to members of Student Chapters. Canadian postage .75¢ and foreign postage $2.50 additional. Entered as second class matter September 23, 1930, at the Post Office, Easton, Pa., under the Act of August 24, 1912, and accepted for mailing at a special rate of postage provided for in Section 1103, Act of October 3, 1917, authorized on July 5, 1918.

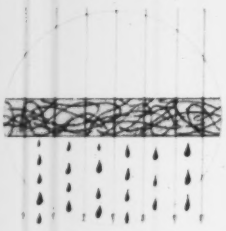
How tracing paper is made and why ALBANENE* is Different

TOUGH, LONG-FIBER PAPER
NOT TRANSPARENTIZED



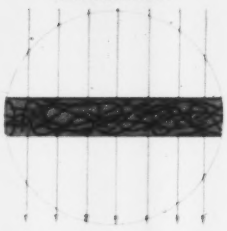
Diagrammatic enlargement of cross section of paper with high strength but low transparency. Fibers are surrounded by air, which has different index of refraction. Many light rays are bent back and do not get through.

SAME PAPER
TRANSPARENTIZED WITH FLUID MATERIAL



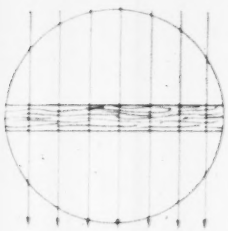
Same paper as "A", filled with oil or other fluid material, giving spaces between fibers same index of refraction as fibers. Reflection and refraction of light are reduced and paper becomes highly transparent. But transparency is not permanent because *fluids* "bleed" out.†

SAME PAPER
TRANSPARENTIZED THE ALBANENE WAY



Same paper as "A", filled with an inert synthetic resin, with correct index of refraction. This is how Albanene is made. Its transparentizer does not "bleed" out. Albanene holds its color and strength and is permanently transparent.†

PAPER TRANSPARENTIZED BY
CRUSHING AND BEATING FIBERS



Papers are also transparentized at the mill by a "beating" process. The fibers are crushed, flattened and compacted. Reflection and refraction of light are reduced. But the process weakens the fibers and the strength of the transparent paper is low.

More than 15 tests are made during production of Albanene. For example, each production roll is tested for pencil "take", for pencil erasing and the taking of drawing ink. To eliminate human variables, pencil lines are drawn by machine. In this way you are assured of the uniformity of working surface so much desired by draftsmen, and assured of a paper that makes cleaner, sharper prints . . . now or a generation later. Ask your K&E Distributor or Branch for further information.

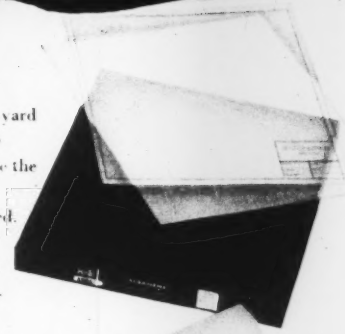
† Prove this by making the "drafting tape-test". Press a short piece of drafting tape on fluid-transparentized paper, and another on Albanene. Strip them off the next day and examine both papers. Notice that enough fluid has drafted out of the ordinary paper into the tape to destroy much of the transparency. And notice that Albanene is not affected. What drafting tape does over night, time will do naturally.

*TRADE MARKS R.

Transparent . . . and Better!

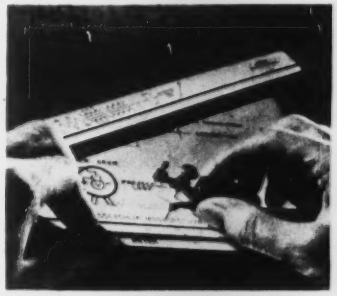
AVAILABLE IN MANY FORMS FOR MANY USES

Albanene comes in 20-yard and 50-yard rolls in various widths and in three different weights. For those who like the convenience of cut sheets, a new Albanene package has been designed. It strongly protects the paper in shipment and storage, and may be opened without mutilating the container, thus serves as a dispenser in drafting room or stock room. Albanene cut sheets can be supplied imprinted to your specifications.



The Right Angle

Once you've discovered the pleasure of drawing on Albanene, the next logical step is to save time, trouble and eyesight with a K&E PARAGON* Drafting Machine. You control your calibrated straight edge with a light touch of one hand, for parallel lines and lines at any angle.



Make your lettering letter-perfect and save wear and tear on your nerves by using a LEROY* lettering outfit. Template grooves guide your pen so the finished result looks like printers' type, and the whole process is relaxing. There's a wide choice of sizes, styles and symbols.

K+E

KEUFFEL & ESSER CO.

New York's City Hall, completed in 1811, as it looked 100 years ago

The City of New York has several cast iron water mains in service that were laid more than a century ago. They are part of approximately 5,000 miles of cast iron mains representing about 98% of all the pipe in New York's distribution system. The contrast in traffic and construction, above and underground, today and 100 years ago, is fantastic. Yet the shock-strength, crushing-strength and beam-strength of cast iron mains have enabled them to withstand the unforeseen stresses imposed by vast changes. Because of these strength factors and effective resistance to corrosion, cast iron water and gas mains laid over 100 years ago, are still serving in the streets of 38 cities in the United States and Canada.

United States Pipe and Foundry Company, General Offices, Burlington, N. J. Plants and Sales Offices Throughout the U. S. A.

U.S. cast iron PIPE

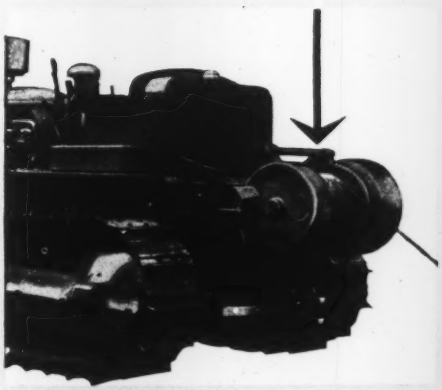
FOR WATER, GAS, SPRINKLER AND INDUSTRIAL SERVICE

NUMBER TEN OF A SERIES

Winching out, and simultaneously loading, a scraper outfit on a construction project in Tennessee. Hyster D7N towing winch mounted on a Caterpillar D7 tractor equipped with 7S dozer and front cable control.

...Don't let mud **bog down** your operations

HYSTER Winches have *R-E-A-C-H* and *Pull Power* for any construction job...



Hyster Tractor Winches are manufactured for use with Caterpillar D8, D7, D6, D4, D2 and DW-10 tractors. Included are Towing Winches, Worm Drive Winches, Hy-Speed Winches, Oil Well Servicing Winches, two and three drum Tractor Mounted Hoists.

Construction men all know the job insurance provided by a Hyster winch mounted on a Caterpillar diesel tractor. The winch MOVES heavy equipment; RESCUES mud-bogged equipment; INSURES against work stoppage or down-time on any project using equipment; PULLS the tractor itself out of mud or other situations that have immobilized the unit.

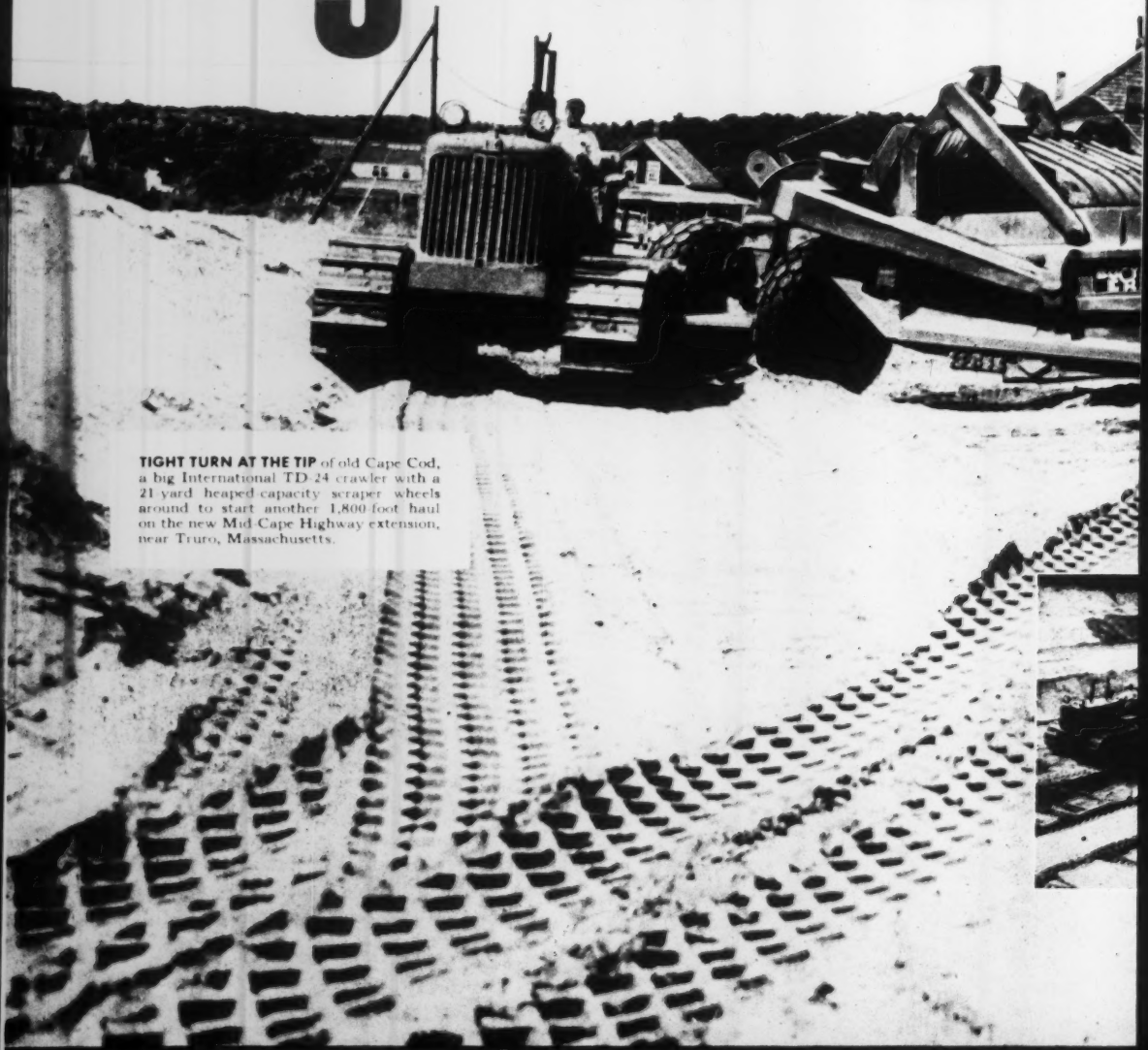
Hyster winches and other tractor tools are sold and serviced at more than 700 Caterpillar dealer stores around the world. Consult your dealer. Write for literature.

HYSTER COMPANY

2999 N. E. Clackamas, Portland 8, Oregon
1899 North Adams Street, Peoria 1, Illinois

MORE THAN 40,000 SATISFIED WINCH OWNERS

Big Red TD 24



TIGHT TURN AT THE TIP of old Cape Cod, a big International TD-24 crawler with a 21-yard heaped-capacity scraper wheels around to start another 1,800-foot haul on the new Mid-Cape Highway extension, near Truro, Massachusetts.

takes the Cape

BIG RED EQUIPMENT. Here are three of the five Internationals on this job, dozing and hauling the loose, shifting Cape Cod sand. In some bogs, peat has to be replaced with sand, and 50-foot piles driven in for stability of the roadway.

Makes tracks near Truro on sand-slowed highway job

Out near the tip of Cape Cod, where the Pilgrims saw their first tracks of redskins in the sand, today's tourists see the tracks of big red Internationals.

They're extending the Mid-Cape Highway, and where the land isn't sand, it's bog and marsh. It's so bad the S & M Construction Company, of Providence, R. I., won't let many of its vehicles venture off the pavement. But the Internationals charge ahead, moving nearly half-a-million cubic yards of sand to build three miles of road.

Pride of the whole show is "Big Red"—the TD-24—pulling bigger loads faster than any other crawler can.

And here's what an S & M operator says about it: "I wasn't on this rig very long before I found out it was mighty nice to handle. I really pull plenty of dirt!"

"Big Red", with 148 maximum drawbar horsepower and up to 7.8 mph, has more power and speed than any other crawler on the market. And it has finger-tip maneuverability to make pivot turns, feathered turns, and turns with power on both tracks.

All this means a faster work-cycle and more paydirt moved per day.

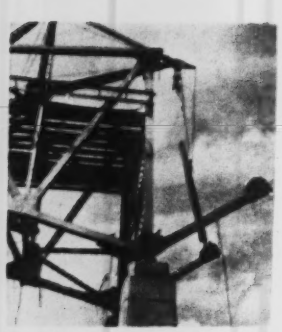
Ask your International Industrial Distributor for details on the TD-24. Ask him, too, about his fast, ready service and speedy parts delivery. Get all the answers . . . and you'll be a TD-24 man from then on in!

INTERNATIONAL HARVESTER COMPANY, CHICAGO 1, ILL.

INTERNATIONAL

POWER THAT PAYS

INTERNATIONAL HARVESTER



This closeup shows start of erection of a cantilever truss span over main river pier, without use of falsework.

New Bridge Over Schuylkill at Philadelphia

Penrose Avenue Bridge helps to speed traffic between Philadelphia and Chester. *Owner:* Commonwealth of Pennsylvania, Department of Highways. *Consulting Engineers:* Modjeski and Masters, Harrisburg, Pa.

This long, graceful structure, recently completed in Philadelphia, stretches its steel fingers across the Schuylkill River a short distance above its confluence with the Delaware River. It is called the Penrose Avenue Bridge, and it was built to ease traffic congestion between Philadelphia and Chester. The bridge replaces a former swing span which had been so severely damaged by a passing ship as to be rendered useless.

This new giant among eastern bridges is a high-level cantilever bridge, its steel construction being 7876 ft long. It stands 148 ft above mean low water. The main channel cantilever span consists of two 340-ft anchor arms and a 680-ft central span. The approaches to the bridge are of continuous plate-girder construction, each approach consisting of 27 spans.

The bridge is 61 ft wide, and has a 4-lane roadway, divided by a 3-ft median strip, and two 5-ft sidewalks.

The superstructure for the Penrose Avenue Bridge, weighing 14,892 tons, was fabricated and erected by Bethlehem.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation
Export Distributor: Bethlehem Steel Export Corporation

★ BETHLEHEM STEEL ★

FABRICATED STEEL CONSTRUCTION

Three of these "Cat" Diesel DW20 Tractors with No. 20 Scrapers haul 3,000 yards of earth a day. Average trip, 1.8 miles; average round-trip time, 9 minutes.

How Oakland tackles traffic problem

"Caterpillar" Diesel No. 12 Motor Grader leveling fill dirt on the Eastshore Freeway project.

"Cat" Diesel D8 Tractor with No. 85 'Dozer pulls No. 28 Ripper on the Eastshore Freeway, under construction near Oakland, Calif.

Scheduled for completion next month, a new 4.2-mile addition to California's Eastshore Freeway will relieve pressure on traffic in the busy Oakland area. This latest section of the Freeway is being built by Fredrickson & Watson, Oakland.

When finished completely, the Freeway, begun in late 1947, will carry traffic from Vallejo to San Jose and will permit a speed of 55 miles per hour within a few blocks of Oakland's business district.

325,000 yards of earth had to be moved in the 4.2 miles now being completed, with 26,000 yards of concrete pavement and 8,700 yards of concrete over-structures poured.

"Caterpillar" Diesel Tractors, Scrapers, Motor Graders, Bulldozers and a Diesel Engine are being used by Fredrickson & Watson to speed completion of the project. Speaking recently of the "Cat" Diesel DW20 Tractors in particular, Construction Superintendent K. Poss said, "We purchased the first DW20s on the West Coast because of 'Caterpillar's' reputation and service rendered on other equipment. We like them and they are performing the kind and amount of work we anticipated. Their ease of operation for size, and their speed, make them the best yet."

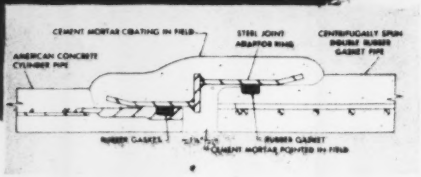
CATERPILLAR TRACTOR CO. • PEORIA, ILLINOIS

CATERPILLAR REG. U. S. PAT. OFF.

DIESEL ENGINES • TRACTORS
MOTOR GRADERS
EARTHMOVING EQUIPMENT

A Money-Saving Combination!

Wherever Pressure Conditions Permit-- Different Classes of American Reinforced Concrete Pressure Pipe Can Be Combined in the Same Water Transmission Line


CEMENT MORTAR COATING IN FIELD
STEEL JOINT ADAPTOR RING
CENTRIFUGALLY SPUN DOUBLE RUBBER GASKET PIPE
AMERICAN CONCRETE CYLINDER PIPE
RUBBER GASKET
RUBBER GASKET
CEMENT MORTAR POINTED IN FIELD

Here's a typical example of the ability of American to meet specific project requirements . . . to give you a carefully laid out and engineered pipe line. You'll like the simplified planning and ease of installation this feature gives you.

By designing your pipe line to meet such specific project requirements you will achieve . . .

Greater Economy in Cost!

You know that reinforced concrete pressure pipe gives you the strength of steel and the permanence of concrete . . . with reductions in initial cost, lower installation costs, sustained capacity, and trouble-free service. Four classes of reinforced concrete pressure pipe are available to meet varying requirements.

So why not use the proper combination of these classes of pipe, where pressure ranges differ, to meet the needs not only of high pressure service but the needs of intermediate and low pressure service as well?

You'll find it the most economical way to plan a major capital investment . . .

. . . with Greater Savings in Critical Materials!

The conservative design principles of reinforced concrete pressure pipe are such that economical use may be made of steel and concrete to meet design requirements with appreciable savings in critical materials.

During the present defense emergency, these are valuable savings to make . . . and, they are savings that ease the problems of procurement, with less drain on the national economy.

So . . . if you find that the pressure ranges in your line are going to differ widely, give us the opportunity to show you how the combination of different classes of American reinforced concrete pressure pipe can save you money.

How American Concrete Cylinder Pipe Is Joined To American Non-Cylinder Pressure Pipe

A simple adaptor ring provides the transition between the spigot ends of two different classes of pipe.

In all classes of reinforced concrete pressure pipe manufactured by American, the rubber gasket is confined by a joint ring to a definite groove in the spigot end of the pipe, thus assuring the most positive and safest use of the gasket as a water seal under all normal operating conditions.

Recent Typical Installations Where This Feature Is Being Used to Obtain REDUCTIONS IN THE COST OF DELIVERED WATER

San Dieguito Irrigation District, Encinitas, California

City of Whittier, California

City of Pasadena, California

Pomona Valley Municipal Water District (now being installed) Pomona, California

Four Plants to Serve You

American manufactures four classes of reinforced concrete pressure pipe in diameters ranging from 12 in. to 12 ft., and for all pressures related to to modern American waterworks practice.

American PIPE AND CONSTRUCTION CO.

Concrete Pipe for Main Water Supply Lines, Storm and Sanitary Sewers, Subaqueous Pipe Lines
P. O. Box 3428, Terminal Annex, Los Angeles 54, California

MAIN OFFICES AND PLANT—4635 FIRESTONE BOULEVARD, SOUTH GATE, CALIFORNIA
DISTRICT OFFICES AND PLANTS—OAKLAND—SAN DIEGO—PORTLAND, OREGON

Huge fabricating capacity and erecting short cuts count on big jobs

International Harvester Company, Broadview Parts Depot—4500 tons of steel fabricated and erected.

29 acres under one roof

Large jobs like this can be fabricated simultaneously in all three of our shops where identical equipment is available. That means speed which is pretty hard to duplicate. On location, the skill of erecting crews in getting the structure up means more speed and time saved.

Wherever structural steel is involved in large, small, or in-between size structures, send your plans and specifications to us to be estimated.

★ Clinton Bridge Corporation ★ Gage Structural Steel Corporation ★ Midland Structural Steel Corporation

Fabricators and erectors of structural steel for highway and railroad bridges; industrial, office, school, and government buildings; Airport structures; Harbor facilities.

CLAY PIPE—*ESSENTIAL* ★ *ECONOMICAL* ★ *EVERLASTING*

Tucson, Arizona, enlarges its municipal sewerage facilities in a $2 million program caused by defense expansion. Clay Pipe is specified not only for the sewerage project, but for the new electronics plant, the adjacent airport, the additional housing, and the Air Force base which made it necessary.

84 MILES OF CLAY PIPE INSTALLED IN TUCSON MUNICIPAL SEWERAGE PROJECT

Over 440,000 feet of Vitrified Clay Pipe, in sizes ranging from eight to twenty-one inches, are being installed to meet the problems posed by defense plant, airfield, and housing construction in Tucson. The defense projects, totalling over $20 million, have caused an influx of thousands of people. Vitrified Clay Pipe sewerage systems will give them the *permanent*, corrosion-proof sanitary facilities that prevent sickness and epidemics.

Clay Pipe is the *only* chemically inert pipe . . . the only pipe that's unaffected by rust, rot, decay, sewage gases, or acid action. It's the one pipe that has *proved* its resistance to chemical action through decades of actual performance in the ground. Don't take chances with non-clay materials. Specify Vitrified Clay Pipe . . . *it never wears out!*

NATIONAL CLAY PIPE MANUFACTURERS, INC.
311 High Long Bldg., 5 E. Long St., Columbus 15, Ohio
703 Ninth & Hill Bldg., Los Angeles 15, Calif.
100 N. LaSalle St., Rm. 2100, Chicago 2, Ill.
206 Connally Bldg., Atlanta 3, Ga.

WHEREVER RELIABLE, PERFORMANCE-PROVED PIPE IS NEEDED, SPECIFICATIONS CALL FOR VITRIFIED CLAY

Rantoul, Ill. (Chanute Field)	158,000 ft.
Orlando, Fla. (Air Force Base)	74,000 ft.
Morrisville, Pa. (New Steel Defense Plant)	300,000 ft.
Rapid City, S. D. (Air Base)	54,000 ft.
Bakersfield, Calif. (Air Base)	196,000 ft.
Panama City, Fla. (Municipal Expansion)	450,000 ft.
Limestone, Me. (Air Force Base)	65,000 ft.
Tucson, Ariz. (Air Base)	440,000 ft.

Vitrified
CLAY
CLAY PIPE NEVER WEARS OUT!
PIPE

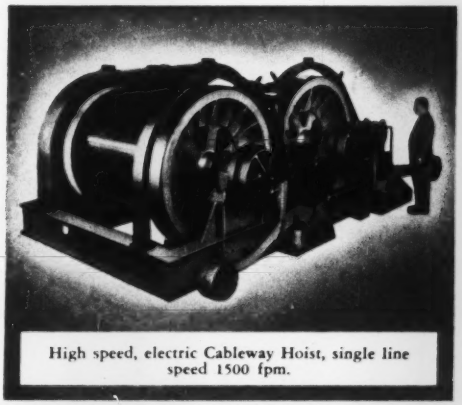
C-352-1

LIDGERWOOD

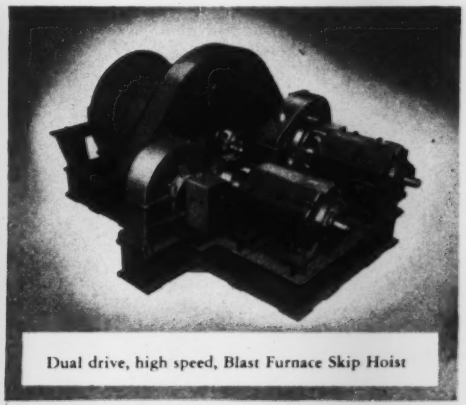
DESIGNERS AND BUILDERS

of Quality Hoisting Machinery

SINCE 1875

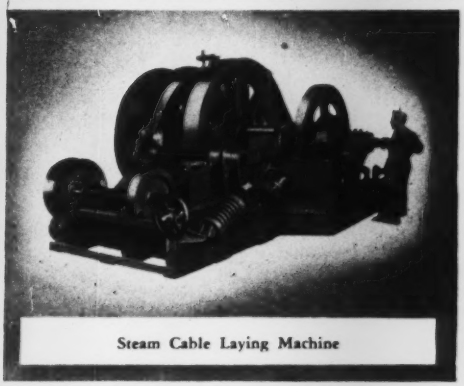


High speed, electric Cableway Hoist, single line speed 1500 fpm.



Dual drive, high speed, Blast Furnace Skip Hoist

Special Cableway Hoist for handling personnel



Steam Cable Laying Machine

We also build
Cableways—Every type—
Loads up to 150 tons.
Electro-Hydraulic
Marine Machinery.
Denny-Brown Ship Stabilizers.
Special Machinery

LIDGERWOOD INDUSTRIES, Inc.

7 DEY STREET, NEW YORK 7, N. Y.

Why they

call this pipe

*America's No.1 Tax Saver

Top Tax Saver is the cast iron pipe in the water distribution systems of cities and towns throughout America. Beyond question, long-lived cast iron pipe has saved, and today is saving taxpayers millions of dollars. Why?

An estimated 60% of the $6-billion cumulative investment in America's water supply systems is represented by pipe and labor for the construction of supply and distribution mains, paid for usually by the issuance of bonds.

Leading waterworks engineers estimate the useful life of cast iron pipe at *4 to 5 times* the average term of a water revenue bond issue. They base their estimates on the fact that over 35 American cities have cast iron mains in service that were installed more than 100 years ago. Moreover, a survey sponsored by three waterworks associations shows that 96% of all six-inch and larger cast iron pipe *ever laid* in 25 typical cities, are still in service. Thus, the *strength factors* of long life, native to cast iron pipe, are self-evident.

When you consider that over 95% of America's water distribution systems are constructed with long-lived cast iron pipe, can you doubt that it is *America's No. 1 Tax Saver?*

America's oldest functioning water main is in its 135th year of service in Philadelphia's distribution system. Cast iron, of course. Over 80 other cities have century-old cast iron mains in service.

CAST IRON

CAST IRON PIPE

America's No.1 Tax Saver

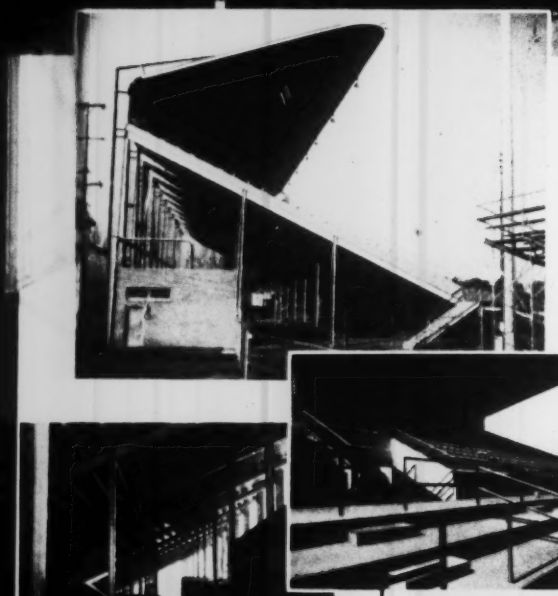
*© 1952, Cast Iron Pipe Research Association

CAST IRON PIPE RESEARCH ASSOCIATION, THOS. F. WOLFE, MANAGING DIRECTOR, 122 SO. MICHIGAN AVE., CHICAGO 3.

AT THE

Merced County Fair

every spectator under the roof enjoys an unobstructed view!



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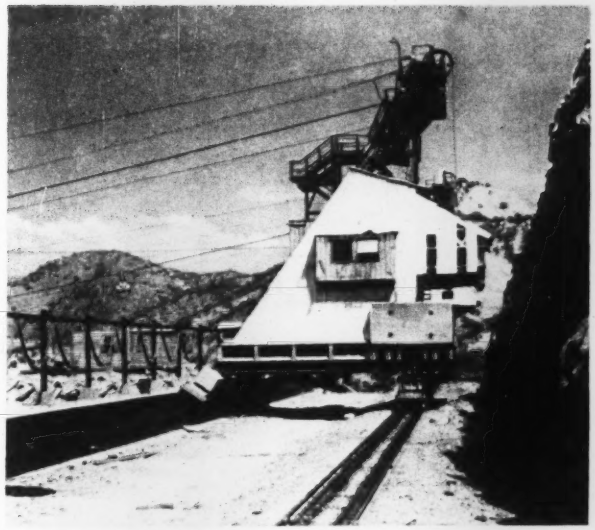

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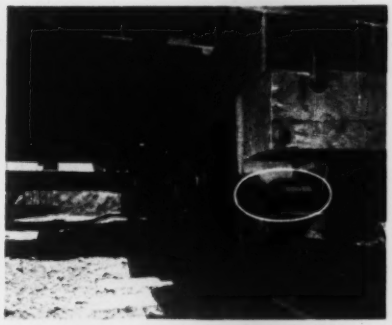

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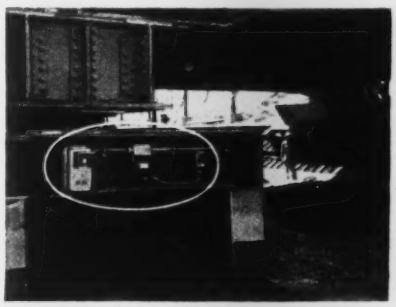

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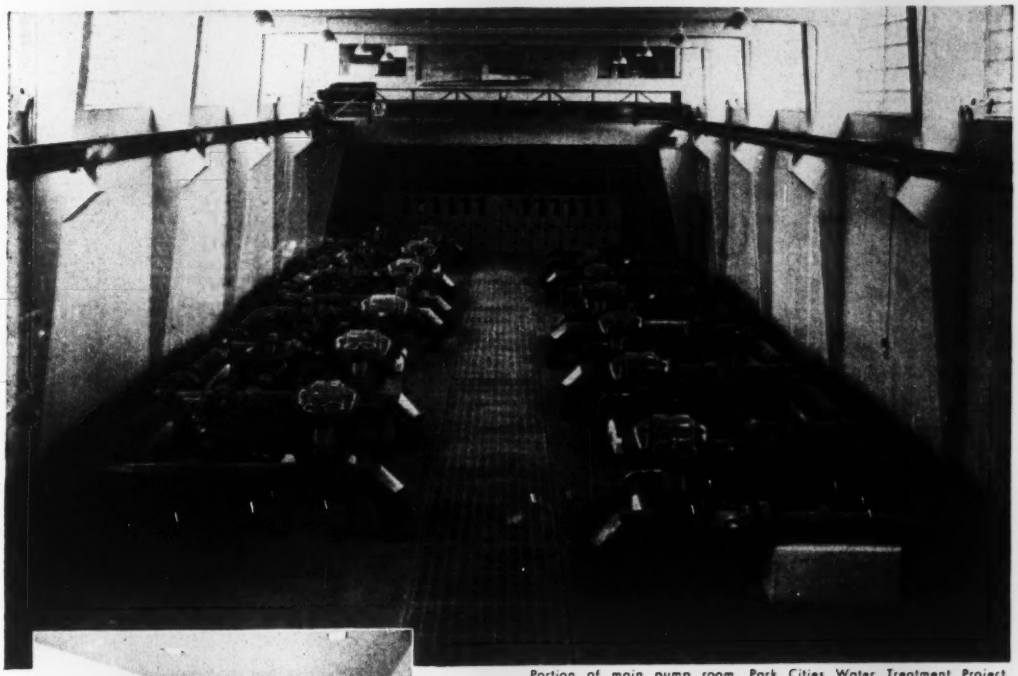
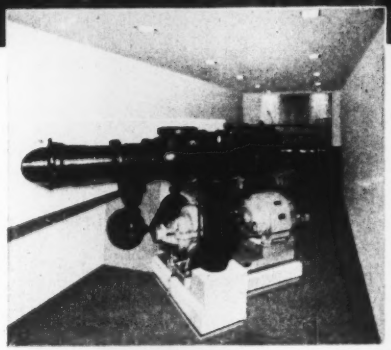


Portion of main pump room, Park Cities Water Treatment Project. Shown are 13 of the 22 Economy Pumps installed on this project.



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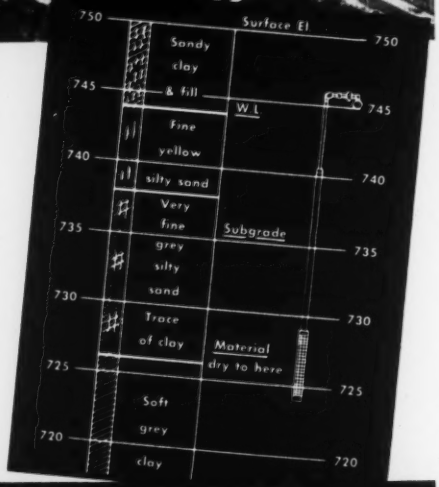

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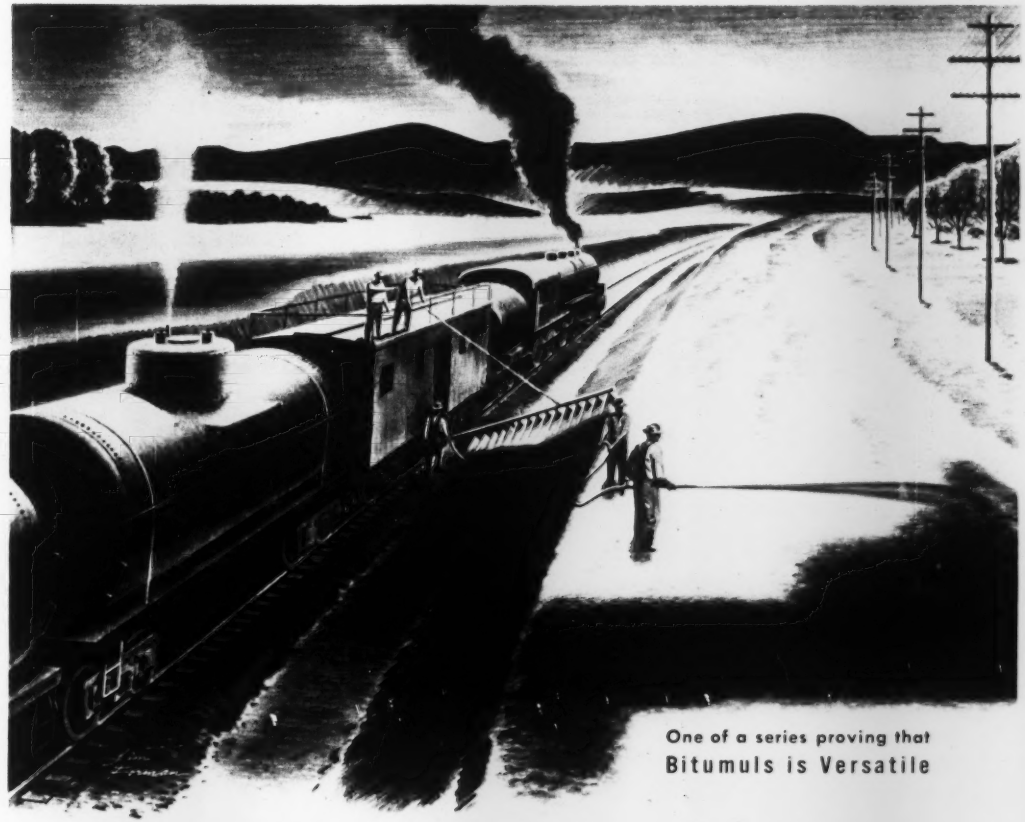

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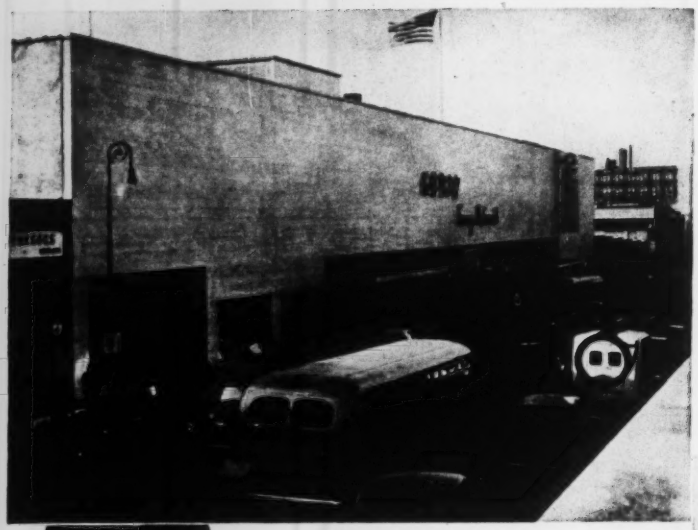

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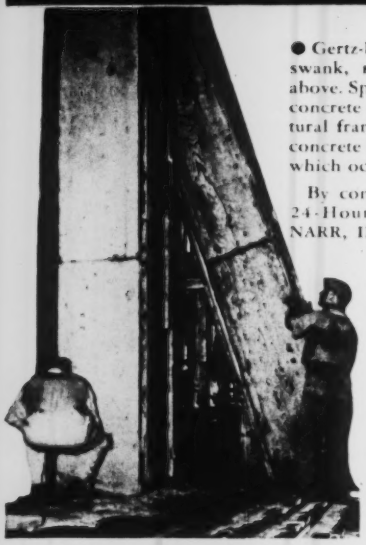

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FIG. 1. Diagonal wire-rope stays which saved Coosa River pipeline bridge are in form of vertical trusses between each main cable and suspended pipeline. Main cables form top chords and bottom pipe constitutes bottom chord. By this means rigidity of span was increased 41 percent. Before addition of stays bridge was seriously threatened by continuous vertical oscillations. Type of vibration made dampers ineffective and navigation precluded use of anchors.

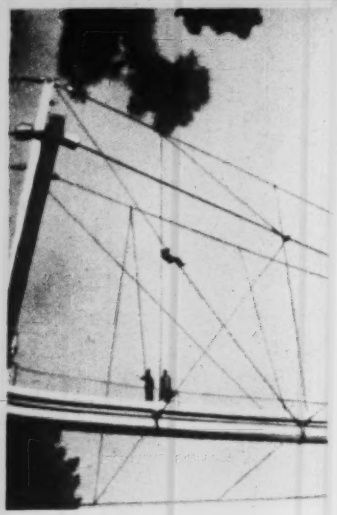
Pipeline bridge stabilized with diagonal rope stays

D. B. STEINMAN, M. ASCE,

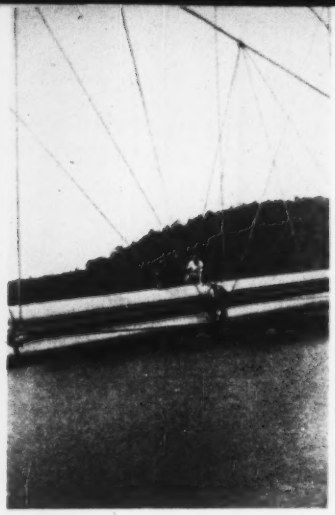
Consulting Engineer, New York, N.Y.

Continued vertical oscillations at low wind velocities threatened the life of a suspended pipeline through fatigue failure. Such an accident would have been catastrophic from the standpoint of the natural-gas-pipeline transmission company. Various damping and restraining devices had been applied, including suspended sea-anchors and dynamic (spring-type) vibration absorbers, but oscillations of serious amplitude persisted.

The recommended solution was to install a light system of diagonal wire-rope stays (Fig. 1) so as to form trussing between each main cable and the suspended pipeline. This simple and economical solution has proved highly successful, virtually eliminating the aerodynamic oscillations. The double amplitudes were reduced from reported values as high as 3 ft and measured values up to 12 in. (after restraining and damping devices had been installed) to the present maximum of a fraction of an inch (with the dynamic vibration absorbers and emergency sea-anchors discarded.)



High tension on wire stay is demonstrated by lack of slack while supporting a man's weight. This tension added materially to over-all rigidity of structure.



Wire stays are fastened to main cable and to bottom pipe, which does not carry gas but serves only as spare in case of damage to top pipe.

This pipeline bridge, which crosses the Coosa River near Clayton, Ala., has a 700 ft main span with straight backstays. It is stiffened transversely by wind cables located approximately in the horizontal plane of the floorbeams. Originally no vertical stiffening was provided apart from the minor stiffness of the two 30 in. steel pipelines themselves.

The structure, as initially constructed with only one pipeline, was completed in March 1950. Alarming and persistent vertical oscillations were observed soon after the pipe was installed. Various theories were advanced, erroneously attributing the oscillations to such factors as temperature effects, locked up stresses, gas under pressure, lack of expansion loops in pipes, and sun on one side of the pipes. In November 1950, the contractor added a second (lower) 30 in. pipe, as a spare not connected for service, with the thought that it would contribute additional stiffness for stability. The increase in span rigidity (due to augmented cable tension, H) was offset, however, by the virtual doubling of the exciting and amplifying oscillating lift force induced by the added cylinder.

After the second pipe was added and the oscillations continued, the contractor improvised emergency sea anchors consisting of 5 gal oil cans filled with rocks and suspended in the river below. An emergency crew had to stand by with a boat in readiness to attach the sea anchors whenever wind and oscillations became serious. To permit free navigation, the sea anchors had to be disconnected after each emergency use.

The contractor made a further attempt to restrain the oscillations by adding a spring damper connected at mid span, a special device of the type that is technically known as a "Frahm dynamic vibration absorber." Theoretically such a device requires that the frequency of the spring damper be resonant with that of the impressed oscillating force, and it can be fully effective only when the impressed frequency is constant. This was not the case here since the impressed frequency (the von Kármán vortex effect) varies proportionately with the wind velocity.

After these various expedients had proved unsatisfactory, the contractor retained the writer to devise a solution to stabilize the structure.

Critical Wind Velocity Range

The coefficient of rigidity or "spring constant," K, of any span is a measure of the elastic resistance of the structure to deformations or oscillations. For the Coosa River span, oscillating in one segment (which was the prevailing condition), the computed value of K was 78. From this value, the natural frequency of oscillations, N, was computed to be 27.3 cycles per minute. The observed frequency was 28.

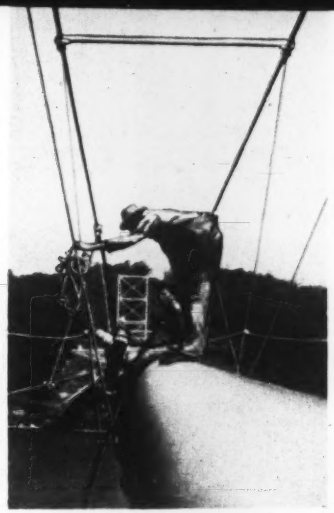
Wind tunnel tests on a section model of the two pipes on the bridge, made by Prof. F. L. Maher at Virginia Polytechnic Institute, indicated that the critical instability range of the bridge was for wind velocities between 6 and 15 mph. The computed effect of adding stays was to increase the value of K by 41 percent and N by 20 percent, thus raising the critical velocity only 20 percent, into the 7 to 17 mph range. After stiffening had been carried out, with the even more significant increase of 50 percent in structural damping, oscillations in the critical range of wind velocities were practically eliminated. The residual potential amplitudes were reduced to a negligible amount.

Two Categories of Instability

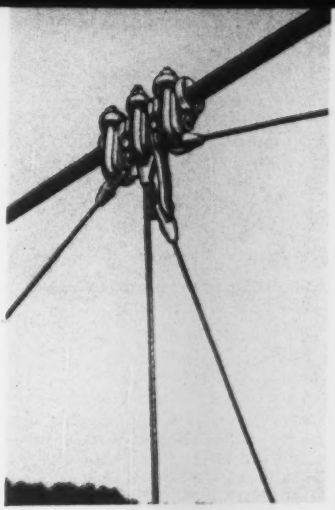
The aerodynamic instability of a cylinder must be distinguished from the instability of conventional bridge cross-sections. The two are contrasting phenomena, although the manifestations and catastrophic consequences may be similar. Instability problems fall into two contrasting categories: self-excited vibrations and forced vibrations. (See "Problems of Aerodynamic and Hydrodynamic Stability," by the writer, in Proceedings of the Third Hydraulics Conference, Bulletin 31, University of Iowa Studies in Engineering, 1947.)

In the case of a self-excited vibration, the alternating force that amplifies and sustains the oscillation is created or controlled by the oscillation itself. In such a case, the alternating force is automatically resonant with the natural frequency of oscillations. The "galloping" of ice-coated transmission lines, the "flutter" of airplane wings and control surfaces, and the wind-induced oscillations of flexible bridge spans (of conventional forms) fall into this category.

In a forced vibration, on the other hand, the alternating force that initiates, amplifies, and sustains the vibration exists independently of the vibration and persists even when the vibratory motion is stopped. In such a case, the frequency of the alternating force is independent of



Initial tension in diagonal stays was 3,000 lb. Stay connections are designed for 9,000 lb.



Diagonal stays are connected to main cable at same point as suspenders. Typical connection is shown.

the natural frequency of the vibration, and amplification depends upon accidental resonance or proximity to resonance. Vibrations identified with vortex shedding are in this category. The simplest and most familiar case is the aerodynamic oscillation of a cylinder. Common examples are the "singing" of telephone wires; the vibrations of submarine periscopes, towing cables, and other submerged cylindrical parts of naval equipment; the vibrations of smokestacks; and the wind-induced oscillations of pipeline spans.

All these phenomena are related in that they involve vibrations initiated or amplified by energy drawn from the flow of the surrounding fluid medium. These stability problems are challenging to the engineer because the attendant vibrations may have serious effects, including impairment or nullification of usefulness (as in periscopes), increase in drag (as in airplane parts), fatigue failure (as in telephone wires), rupture from a normal stress (as in transmission lines), and physical destruction (as in a bridge).

The problem of cylinder vibration must be differentiated from the more general problem of aerodynamic instability. Different test criteria apply, and the mathematical analysis is quite different and considerably simpler.

As is well known in hydrodynamics, when a fluid moves steadily past a stationary immersed cylinder, alternate eddies are shed periodically from the cylinder, forming the von Kármán vortex trail. Each time an eddy is released, an unbalanced transverse force acts on the cylinder. If the cylinder is free to vibrate transversely, the alternating transverse forces may impose upon it a forced vibration with a frequency equal to the eddy frequency. If the eddy frequency is in a critical range related to the natural frequency of the cylinder, the vibration of the cylinder may attain a high amplitude. It is this phenomenon of forced vibrations which produces the oscillations of pipeline structures such as the Coosa River bridge.

In this connection, a common misconception needs correction. The oscillations of a cylinder under these conditions are not caused or produced by the vortexes. The vortexes in the wake of the fluid medium are merely counters, markers, or footprints providing a convenient physical and mathematical trail from which the "circulation" about the cylinder and the consequent lateral forces acting on the cylinder can be inferred, formulated, and computed.

Studies of Modified Sections

Included in the studies were tests of various methods of modifying the exposed sections of the cylinders so as to break up the aerodynamic "circulation" represented by the von Kármán vortex trail and thus remove the cause of the instability of the bridge. Several shapes of vanes and fairing were tested on office models and in the wind tunnel of the Virginia Polytechnic Institute. Vanes on one side of a pipe are effective for wind in one direction only. For wind in changing directions, a symmetrical fairing is required. Fairing sections were not entirely satisfactory, however, and estimates of cost indicated that such installations would require an expenditure two or three times that for the simple cable-stay system adopted.

The recommended and adopted installation for stiffening and stabilizing the bridge consists of a system of light ($1\frac{1}{2}$-in.) wire-rope diagonal stays. This is equivalent to forming a vertical truss with the two main cables of the bridge forming the top chord and the bottom 30-in. pipe constituting the bottom chord. A single Warren system was used, with each stay having an initial tension of about 3,000 lb. This initial tension, when sufficient to prevent reversal of stress in any cycle of oscillation, enables each stay to act with full effectiveness (equivalent to a compression member) throughout the cycle. The stays at mid span are also particularly effective in preventing two-segment oscillations. All the stays were made of $\frac{1}{2}$-in. dia. 6×7 galvanized plow-steel ropes.

The system of stays described above increased the rigidity (spring constant, K) of the span 41 percent. Even more important than this increase in rigidity was the concomitant increase of 59 percent in the structural damping. The residual amplitudes of oscillations in the structure were thus reduced to negligible magnitudes—less than $\frac{1}{2}$ in. The total cost of the installation was only $7,368.

The Coosa River pipeline bridge was built by the Austin Bridge Co. for Fish Constructors, Inc., the latter acting as agent for the Transcontinental Gas Pipeline Corp. The installation was made under the direction of Shannon Miller, M. ASCE, Construction Engineer of the Austin Bridge Co.

Important developments in concrete for

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Mass concrete in Hungry Horse Dam, Montana, contains 30 percent pozzolanic material known as fly ash, a by-product of coal-burning power plants. Concreting operations started in 1949 and when pouring stopped at end of 1951 working season, dam was 75 percent complete, with 2,401,000 cu yd of concrete in place.

Alkali-Aggregate Reaction

During the past ten years, abundant field and laboratory experience has demonstrated that alkalies in portland cement react with certain siliceous constituents of aggregates with consequent deterioration of the concrete. A description of the phenomena was first published in 1940 by T. E. Stanton, M. ASCE, as a result of experience on California highways. Soon thereafter evidence of similar expansion and deterioration of concrete was discovered in other structures in various parts of the country.

The alkali-aggregate reaction manifests itself as expansion and cracking, accompanied by a decline in the strength, elasticity, and durability of the concrete, which may seriously impair the serviceability of the structure. The destruction is caused by osmotic absorption of water by alkaline silica gels which form through interaction between the aggregate and the alkalies liberated by the high-alkali cement during hydration. The pressures built up by the formation of the gels exceed the tensile strength of the concrete and cause fractures which probably are sufficiently extensive to account for the increase in volume and decline in strength.

Because of the importance of this reaction in the design, construction, and maintenance of concrete structures, many agencies have undertaken a more or less coordinated program of research directed toward finding (1) the causes of the deterioration, (2) details of the phenomena accompanying the deterioration, (3) the characteristics of cements and aggregates which contribute to the reaction, and (4) means by which the action can be controlled or prevented. These investigations involve detailed examination of structures in the field, performance of chemical, physical-

dams reviewed

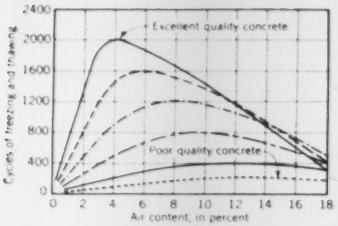

FIG. 1. Optimum air content for durability varies with quality of concrete. Although air entrainment increases durability of all concretes, poor concrete cannot be made into good concrete by this means alone.

chemical, and petrographic studies in the laboratory, and fabrication and testing of mortar and concrete specimens.

Alkali-aggregate reaction in concrete can be controlled by using low-alkali cements or by replacing a part of the portland cement with certain siliceous and aluminous pozzolanic materials.

Pozzolanic Materials

Pozzolans used in mass concrete are defined as any siliceous material, either natural or artificial, processed or unprocessed, which, in the presence of lime and water, will develop cementitious qualities. Recognized pozzolanic materials include some clays, shales, and cherts, diatomaceous earth, volcanic tuffs, pumicites, blast-furnace slag, and fly ash. Fly ash is a fine material recovered from the stacks of furnaces burning powdered coal such as are used in steam-electric power plants.

The growing use in the United States of pozzolanic materials, or of portland-pozzolan cements, has been occasioned to a large extent by the high cost and relatively short supply of portland cement in the years since World War II, as well as by certain specific improvements in the mix thus secured. Pozzolanic materials have been found to be an effective aid in combating alkali-aggregate reactions and in reducing the heat of hydration, both of which are accompanied by objectionable volume change. Other benefits derived from the use of pozzolanic materials include higher tensile strength, increased resistance to sulfate attack, greater extensibility, durability, and impermeability.

The optimum percentage of pozzolan used to replace portland cement will usually vary from 10 to 30 percent, depending on the characteristics of the pozzolanic material and the purpose for which it is used. The mass concrete for Hungry Horse Dam of the Bureau of Reclamation, now about 75 percent complete, contains fly ash which replaces about 30 percent, by weight, of the portland cement. Other pozzolans used in the construction of large dams in the United States in recent years include natural pumicite, river-bottom silt, and calcined shale.

The Corps of Engineers, U. S. Army, is employing a portland-natural cement combination in the construction of several dams. Tests and experience have shown that such a combination also imparts to mass concrete many desirable characteristics.

Air-Entraining Agents

The use of air-entrained concrete has grown rapidly since 1938, when it became evident that air-entrainment greatly increases the durability of concrete for highways. Air-entrained concrete has been used in many large dams built by both the Corps of Engineers and the Bureau of Reclamation, including Angostura, Kortes, Bull Shoals, and Hungry Horse.

From 3 to 5 percent of entrained air in concrete greatly improves the durability and workability, permits a saving in material, and reduces the passage of capillary water, the temperature rise, bleeding, and segregation of concrete. (See Fig. 1.) At the same time it increases the strength of lean mixes, and overcomes deficiencies of poorly graded aggregate. Entrained air makes practical the use of mixes of low cement content, which otherwise would be unworkable and harsh, and would bleed excessively. The advantages of air entrainment far outweigh the disadvantages, such as slightly increased drying shrinkage, increased air voids on form surfaces, reduced strength for rich mixes, and reduced abrasion resistance when the strength is reduced.

Air entrainment in concrete is accomplished by additions of air-entraining agents at the mixer, or by the use of cements to which air-entraining agents have been added during grinding. A number of methods and devices have been developed for the practical measurement of the air entrained in the wet mix, and certain of these are satisfactory for use at the job site.

Prepacked Concrete

A new and ingenious method of making concrete that is finding rather wide application is the Prepakt process developed by the Intrusion Prepakt Company of Cleveland, Ohio, owner of the basic patents for the materials and procedures.

Prepacked concrete is made by first filling the forms with clean, graded coarse aggregate, and then pumping the voids of the aggregate mass full of a special intrusion mortar containing fine sand, portland cement, pozzolanic filler, and certain patented grouting aids. Prepacked concrete differs from ordinary concrete in that there is a higher percentage of coarse aggregate in the finished product. The advantages of the method under special conditions have attracted interest and resulted in extensive laboratory investigations. Prepacked concrete is readily adapted to both repair and new concrete work. Its big advantage for use in repair work is that it has low drying shrinkage and bonds exceedingly well with the original concrete. It can be placed satisfactorily under water, and requires a much simpler plant installation than regular concreting methods.

Artificial Cooling

In addition to efforts to reduce the amount of heat generated by hydration of the cement, considerable work has been done on methods of precooling concrete materials and in extracting heat from structures by artificial means.

Large dams built during hot weather must utilize water and aggregate affected by the ambient temperatures. High temperature of ingredients of course makes for higher initial temperatures of the concrete, with consequent higher temperature due to the heat of hydration. By icing the mixing water and precooling the aggregate, worth while reductions in the initial temperature of concrete mixes have been obtained. Where concrete is pumped, the practice of shading pipes has been adopted.

Extraction of excess heat from concrete in place is often accomplished by circulating cold water through pipes embedded in the concrete.

False Set in Portland Cement

The problem of false set, or premature stiffening, in portland cement has recently become more widespread and is now receiving considerable attention in the United States. On the construction job, false set is evidenced by a significant loss of consistency shortly after mixing. When short mixing periods are used for low-slump concrete, as in mass concreting operations, the use of vibrators is often required to discharge concrete through restricted openings. It is particularly troublesome in cases where the batch stands for a few minutes in a mixer or hopper before being discharged. In less extreme cases, it may appear as excessive loss of slump between the mixer and the forms. When it occurs, it delays construction schedules, causes excessive bleeding, makes uniform control of concrete quality practically impossible, and increases the cost of handling, placing, and finishing work.

False set received considerable attention some years ago, but the problem has not yet been solved. The consensus of opinion is that dehydration of gypsum is responsible for this trouble, and that accelerated production rates are causing the present difficulties.

In the laboratory, false set is most readily identified by a penetration test, showing the loss in consistency of cement paste. Such a test has been included in the acceptance requirements for some of the larger consumers in this country. Research on the problem is continuing and gives promise of uncovering the basic causes of this difficulty. A complete review of the problem and details of research activities is covered in the paper, "False Set in Portland Cement," by R. F. Blanks, M. ASCE, and J. L. Gilliland, presented at the February 1951 meeting of the American Concrete Institute and published in the March 1951 issue of the Institute's *Journal*.

Pattern cracking, here seen on highway overpass in Wyoming, is typical of alkali-aggregate expansion.

Automatic Control of Consistency

Considerable research and job experimentation on methods to automatically control the consistency of concrete on large jobs has resulted in the development of consistency meters. On some jobs, these have been of an electrical-torque type that indicates variations in the power consumption of the mixer motor. A more sensitive meter for use in the stiff, lean concrete common to large-dam construction is one developed by Bureau of Reclamation forces at Grand Coulee Dam.

This meter indicates changes in the overbalancing effect of the concrete in a tilting mixer of the bowl type. In its normal operating position the axis of rotation of the mixer is inclined and any building up of the depth of the concrete in the rear of the bowl tends to upset the balance of the mixer on its trunnions, and to increase the inclination of the axis. The drier mixes, which build up higher than those of more fluid consistency, augment this tendency to overturn, and thus affect the meter reading.

The meter itself consists of an arrangement of links and levers attached to the tilting frame and connected through a cushioning air cylinder to a spring coil, which, as it deflects under the overturning pressure from the drum, actuates a solenoid. As the solenoid core is thus moved, there is a change in the electric current in the fixed coil, which is transmitted to a companion solenoid that operates recording equipment. Accurate batching and reasonable uniformity in aggregate grading are important in the use of this meter, as it is really a means of measuring the fluidity of the batch, and the changes it indicates may be due to causes other than water content.

Consistency meter was developed at Grand Coulee Dam, Washington, and used during construction for automatic control of concrete consistency.

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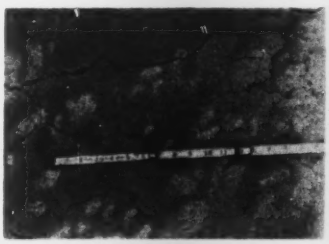

Expansive cracking (above) on surface of Stewart Mountain Dam, Arizona, was caused by alkali-aggregate reaction.

Section of Roman aqueduct (right) built along Rhine River some 2,000 years ago is composed of sand, broken coarse aggregate and a pozzolanic material called trass.

LAW

Conflicting state laws affect interstate contracts

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In the past twenty years large engineering works have taken on an interstate character. This extension across state boundaries of the businesses of engineers and contractors has brought them face to face with the fact that the laws regulating their activities vary widely from state to state. Thus a contract valid in one state may be unenforceable in another, and a statute of limitations may specify four years in one state and six years in another.

Under certain conditions a 7 per cent note for the purchase of equipment would be valid in Illinois but unenforceable in New York. Workmen's compensation statutes in some states limit the recovery for an injury to a statutory table of awards, while the statute in other states permits a widow to plead willful and gross negligence of an employer and, if she wins the suit, to benefit by a potential judgment of several times the statutory award.

Suppose that a $20,000 dragline is bought by making a $2,000 down payment and giving 22 notes for the balance. Suppose further that the purchaser, a contractor, defaults and loses his machine after paying $10,240. Tennessee would grant him recovery of some of his equity in the machine whereas other states would treat his payments merely as rentals. There is also a conflict among state laws as to the effectiveness of collateral liens. Some states hold that the retaking of a piece of a contractor's equipment extinguishes a supporting lien for the unpaid balance.

Requirements as to revenue stamps, witnesses, and seals vary in different states. Some jurisdictions are more inclined than others to bind a principal for the unauthorized contract of an agent.

When a controversy arises as to the operation or discharge of a contract, it is first necessary to determine the state whose laws will govern the case. It should be noted that a court in one state will apply the contractual laws of another state if the facts require. The applicable state law should be determined on the basis of one of the following:

1. Intent of the parties, as expressed or implied in the contract
2. Place of execution, as where the final signature was added, or the place of delivery of the contract
3. Place of performance of the contract
4. Place of remedy or court procedure

As to the first factor, intent, the parties may contract on any terms they desire, so long as the result is not based on fraud or a mistake, and is not against public policy. Thus, two parties may stipulate in their contract that the laws of a particular state will apply, provided the subject matter of the contract has some reference to that state.

Here is a strange case in point. A New York pilot, who was a temporary resident of Tennessee, signed a contract of employment while in Washington, D.C., the contract stipulating that the workmen's compensation laws of Pennsylvania would apply. The company was incorporated in Delaware but had its principal offices in Pennsylvania. The pilot flew from Tennessee, landed in Pittsburgh, and then flew on to Alabama, where he was fatally injured. The widow brought her action in Tennessee, and that court accepted the contract stipulation that the Pennsylvania law would apply. But the Pennsylvania law would grant recovery only to residents of the state either injured within its borders or injured while temporarily out of the state. The deceased met neither requirement, so the location where the injury occurred, Alabama, was used as the governing factor. This state allowed the widow to claim gross negligence of the defendant company and thus sue for a much larger potential recovery.

Place of execution means the place where the final signature is affixed to the contract. Where equipment or materials change hands on a credit basis, the seller may specify that all the documents are to be sent to his home office for final approval and signing. Thus, in the case of a dragline sold on a conditional-sale contract, approval by the home office of the seller in Lima, Ohio, established that the laws of Ohio were applicable, even though the machine was sold by the Tennessee office for delivery in Kansas and for use also in Arkansas and Missouri. This case was tried in Tennessee but the law of Ohio was applied.

Place of performance is usually the governing factor in controversies relating to adequacy of performance. For example, a contract to construct a theater in New Jersey should conform to the laws and building codes of New Jersey. On the other hand, a licensed New York realtor could enter into a valid sale contract with a resident of Pennsylvania who was the owner of a New Jersey office building. It would be immaterial that the New York realtor was not licensed in New Jersey because the parties carried out the contract of sale entirely in New York, and performed no work in New Jersey. Such matters as labor contracts and issues concerning unemployment taxes, social security, garnishment, mechanic's liens, and titles to real estate are governed by the laws of the state where the land is located and the work is done.

Place of remedy means of course the jurisdiction within which the litigation is conducted. State statutes establish rules for the administration of justice, called judicature acts. These acts establish the court rules of evidence, procedure, capacity of parties, and remedies for breached contracts, fraud, duress and various torts. Each state legislature has established the rules for the operation of its own courts.

It is evident that the laws governing contracts in the various states are often in conflict and may be very confusing. Rulings on past cases indicate much inconsistency, due in part to the jurisdictional pride or jealousy of some state courts. Contractors and engineers entering new territory are well advised to obtain early assistance on local laws governing contracts and construction.

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Small community provides sewage treatment at total cost of $125,000

Hayward, Wis., protects vacation attractions

Primarily a recreational center, the city of Hayward, Wis., is widely advertised as the "muskie capital of the world." It is located on the banks of the Namekagon River in the northwestern part of the state. The largest muskies ever caught, according to official records, have been hooked in this vicinity, where thousands of people spend their vacation year after year. Many people in the area are dependent on the vacation trade for their livelihood and of course are interested in preserving the natural beauty of the streams and lakes.

The Namekagon River flows through the city and is the only outlet for sanitary sewage as well as for storm water. All sewage formerly was discharged directly into the river without any treatment. The matter was talked about for many years but nothing concrete was done until about 1945. At that time the general public became aware of the fact that other cities were installing sewage treatment facilities in order to protect the health of their own citizens as well as to prevent serious contamination of recreational facilities.

In 1946 Hitchcock & Estabrook, Inc., were engaged to prepare plans for a complete sanitary sewerage system and a modern sewage treatment plant. The site selected for the plant is owned by the Lake Superior District Power Co., to whom recognition should be given for its cooperation. The company could not donate the site because of the legal rights of bondholders but it did grant the city a 99-year lease on it without charge. The site is located along the west bank of the Namekagon River directly below the power dam. It is fairly level and slopes gently toward the river. There are no buildings nearby except the power plant, and it appears that a sewage plant in this location will never create a nuisance.

Plans were completed in 1947 and approved by the State Board of Health. A project of this size generally requires an appreciable period to acquaint the general public with details and to arrange financing. The project was discussed in the local press and at public meetings, in addition to being talked over by individuals and small groups. Public opinion appeared to crystallize in favor of the project, and accordingly bids were taken in July 1950. They were rejected; the project was readvertised; and new bids were taken in August. Prices were increasing so rapidly that the low bid of August 1950 was some $15,000 higher than that of the preceding month. However, the contract was awarded because it was realized that further delay would only result in additional cost.

The plant is of the bio-filter type and consists of a primary clarifier, a high-rate filter, final clarifier, digester and sludge drying beds (Fig. 1). Sewage enters the plant through an open manhole equipped with a bar screen and shear gate, flows through a grit chamber and into the wet well. From there it is pumped to the primary clarifier, whence it flows through the plant by gravity. The entire plant can be bypassed, if necessary, through a line running from the grit chamber directly to the river.

Supernatant liquor is returned by gravity from the digester to the wet well, where provision has been made to chlorinate, if desired. All piping in and around the plant is of flanged cast iron. There are standard 125-lb gate valves at various points to permit flexibility of operation. Two-hour detention is furnished by both the primary and the final clarifier. Recirculation over the filter is provided from the launder in the final clarifier to a head box at the primary clarifier, thereby keeping construction costs to a minimum while securing adequate treatment.

All structures below grade are of reinforced concrete as is the building over the high-rate filter. Filter media is a clean coarse crushed rock. The control building superstructure is of concrete block with stucco finish on the outside. The clarifiers are not covered. All concrete below grade was waterproofed with two coats of asphalt paint.

Test borings taken in 1947 did not indicate that any serious water problem was likely to arise during construction. In the summer of 1951, however, all previous rainfall records were broken and well points had to be used for all subsurface excavation including the new interceptor from the old sewer line to the new plant. Two rows of points were used, pumping 1,500 gpm almost continuously during excavation and pouring of subsurface structures. The pumps, powered by gasoline, gave little trouble. Excavations extended into gravel and consequently were practically dry, affording excellent working conditions.

The plant contains two raw sewage pumps, each with a capacity of 250 gpm, and so controlled automatically

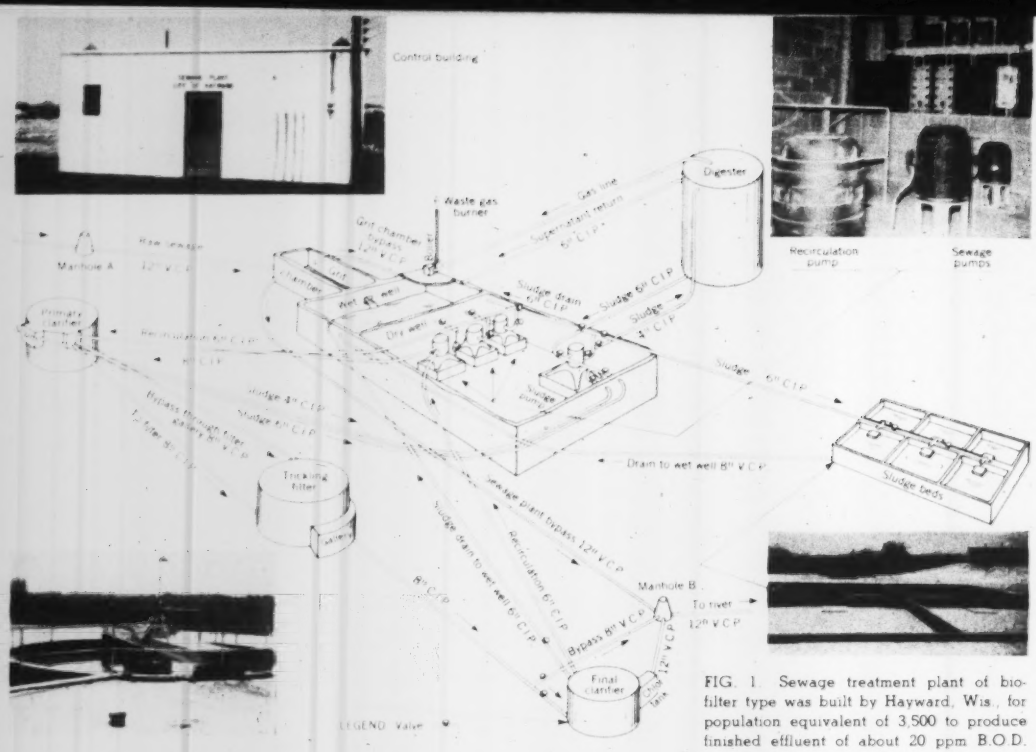


FIG. 1. Sewage treatment plant of bio-filter type was built by Hayward, Wis., for population equivalent of 3,500 to produce finished effluent of about 20 ppm B.O.D.

that it necessary both pumps will operate. To keep costs to a minimum, only one recirculation pump was installed; it operates continuously at 75 gpm. These three sewage pumps were furnished by Fairbanks Morse and Co.

The sludge pump, furnished by Carter, is so connected that it will pump sludge to the digester separately from the primary clarifier and from a scum box at the primary clarifier. It will also pump from the digester to the sludge drying beds. Sludge from the final clarifier returns to the wet well by gravity.

Sludge beds were constructed of farm drain tile laid with open joints and covered with coarse gravel overlaid with pit run sand. All walls are built of concrete blocks laid on a 6-in. concrete footing. The footing is reinforced with wire mesh as it is expected to crack as a result of frost action. The purpose of the walls is to retain sludge and any cracks which develop can be quickly and cheaply calked. A substantial saving was made possible by this method of construction.

A separate chlorine room, with outside entrance only, houses the chlorination equipment, which was furnished by Wallace & Tiernan. The chlorine room is equipped with a platform scale so that the operator can tell at a glance the amount of chlorine remaining in the cylinder. The room, about 6 × 9 ft in floor area, has adequate space for chlorine storage in addition to feeding equipment. Since there is no opening between the chlorine room and the main control room there is no possibility that chlorine gas will enter the main part of the building. A two-point application system is installed so that chlorine can be applied in the wet well and also in the chlorination tank at the final clarifier. Hose lines for chlorine are installed in clay tile so that they can be easily inspected.

A circular steel stairway provides access to the dry well, which forms the basement of the control building, and houses the raw sewage pumps and the sludge pump. The floor of the dry well is sloped to drain to a shallow sump in which is installed a 15-gpm pump with totally enclosed motor which discharges into the wet well. The motor on this pump is float controlled and the entire unit may be submerged without damage. Motors for the raw sewage pumps are located on the main operating floor of the control building. The shafts from the motors to the pumps have universal joints at each end and pillow blocks to prevent any possible whipping of the shafts. There is a small fan in the dry well and another in the wet well. These fans are connected to the lighting circuit in such a way that they will always operate when the light switch is closed. Metal ventilation ducts are also provided.

All mechanical equipment in the clarifiers, the high-rate filter, and the digester, was furnished by the Dorr Company. This equipment is all designed for continuous operation at low speed. Motors on the clarifiers and on the digester are weatherproof and are equipped with overload protective devices.

The heating system, located in the control building, is equipped with a dual-type burner to utilize gas from the digester when available, and otherwise to operate on oil. The hot-water boiler has sufficient capacity to maintain a temperature of 90 deg F in the digester and 60 deg F in the control building at the 30-below-zero temperatures encountered in this area. Hot water is circulated by two separate pumps, one for the digester and one for the control building. The digester is equipped with four rows of 2-in. copper pipe around its periphery, while the control building is heated by one large Trane Co. unit heater with electric fan and thermostatic control. Normally the chlorine room will not be

heated, but a Trane Co. unit heater with electric fan and manual control has been installed for use if needed.

Gas safety equipment, furnished by Varec, includes the usual flame traps, sedimentation tanks, pressure regulator, and waste-gas burner. The latter is located on the roof of the control building.

During construction a good supply of water was found at a depth of about 20 ft near the control building. Therefore a small pressure tank, together with pump and automatic control, was installed in the control building to provide water for general plant use. Thus the construction of some 1,200 ft of water line was avoided, with a substantial saving to the city. The control building contains a toilet and lavatory with both hot and cold running water. There is also a Class C laboratory for running simple tests, so that the operation of the plant can be controlled for maximum efficiency.

The roofs of the filter building and the control building are of reinforced concrete. On the control-building roof, the concrete is covered by 1 in. of fiber-glass insulation, over which is placed a 20-year bond, built-up, asphaltic type of wearing surface. The roof of the filter building is reinforced concrete and is not coated.

All doors and windows, including frames, are of steel. Electrical fixtures and switches in and around the control building are of the explosion-proof type because of the gas hazard.

This project was entirely financed by revenue bonds. It might be cited as an example of what a city can do if its officials are so inclined. The first step in financing was to combine the existing sewer system and the existing municipally owned water system into a combination "sewer-water utility." The consulting engineers prepared a valuation sheet showing the book value of the newly created public utility. A petition was then presented to the State Public Service Commission requesting a certificate of convenience and necessity so that the treatment plant could be constructed. A second petition presented to the Commission requested the establishment of water and sewer rates which would produce sufficient revenue to pay the interest and retire the bonds. No opposition was presented at the public hearing before the Public Service Commission, and accordingly rates were set in accordance with estimated needs.

Water rates are on a sliding scale starting at 45 cents per 1,000 gal of water and dropping to 9 cents per 1,000 gal for large consumers. A sewer service charge is fixed at 100 percent of the water bill. Rates were fixed to provide debt service, operation costs and depreciation. Cost per family for both sewer and water service will average about $60 per year, which is less than the price of a pack of cigarettes a day. This cost is so low that no opposition has appeared since the rates were established and put into effect.

Messrs. Chapman and Cutler of Chicago issued the bond opinion and the bonds, totaling $140,000, were purchased by Quail & Company of Davenport, Iowa, at 3 percent interest. Sale was at par with accrued interest. Short-term government bonds were purchased by the city with the proceeds from the sale of the city bonds, in order to save interest charges during construction, thus realizing a substantial saving.

The John Schlise Construction Co. of Sturgeon Bay, Wis., was the general contractor. Electrical, heating and plumbing work was performed by local contractors. The total construction cost of the plant and sewerage system was $125,000. Based on experience elsewhere, this plant will produce a finished effluent of about 20 ppm B.O.D., which is in accordance with accepted standards. Work was started in June 1951, and the plant was formally accepted on December 10, 1951.

How would you do it?

Some of the most fascinating chapters in the life and memory of an engineer are those which deal with the unusual and unexpected situations which almost got him down but from which he finally emerged the victor.—H. J. Gilkey

A few years ago a government-sponsored housing development was completed in the fall preceding a severe winter. Some of the houses were occupied immediately, but 15 or 20 remained empty during the winter pending formal government acceptance and allocation to tenants.

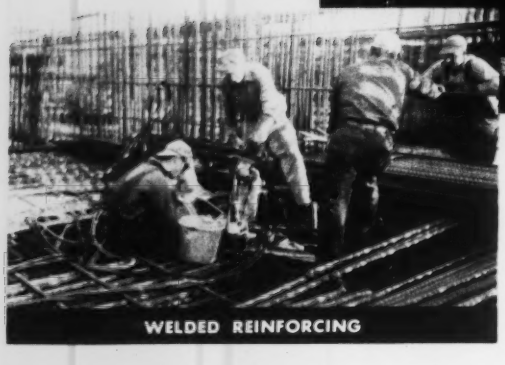
Although they varied in size, the houses were all timber with excavated basements. The superstructure was supported by the concrete basement walls and by a continuous longitudinal girder. This girder was supported at its ends by the exterior basement walls and in between by two posts, which stood on shallow footings extending a few inches below the basement floor slab.

In February some of the houses showed distress where the basement walls joined the superstructure. The basement walls appeared to have settled, and one or both ends of the longitudinal girder hung 2 or 3 in. above these walls. A crack that was more or less continuous ran around the basement floor slab about 3 ft inside the walls, the slab sloping down to the walls from this crack. There were no signs of local damage or cracking in the walls themselves. One of the unoccupied houses and all the occupied houses were found to be free from this damage.

If the trouble was due to frost, as appeared likely, it seemed strange that the basement walls had suffered no damage. If these walls had moved, they had settled instead of heaving, behavior not characteristic of frost action. As usual the explanation, when found, proved to be simple: perhaps you have already guessed it. For solution see p. 96.

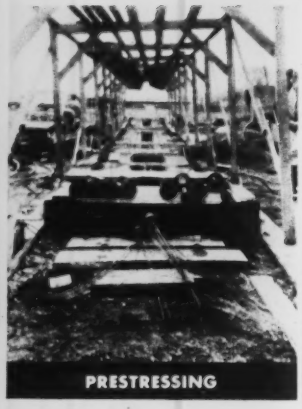
EDITOR'S NOTE: The above problem, for which we are indebted to Prof. H. J. Gilkey, M. ASCE, head of the Department of Theoretical and Applied Mechanics, Iowa State College, is one of a series drawn from actual experience and designed to demonstrate how an engineer overcame one of those "bugs" with which every engineer is familiar. Such experiences are an important part of the engineer's post college education. Hoping that these problems will prove valuable to those who have never encountered them before and entertaining to those whose memories are thus drawn back to similar experiences of their own, the editors welcome contributions to this column.

MASSIVE REINFORCING



WELDED REINFORCING

Structural uniqueness of concrete boxes for Pier 57 consists not only in massiveness of reinforcing but also in construction methods employed, which embody such up-to-date techniques as union-melt, butt-welded reinforcing bars and prestressed concrete stringers for main deck.



PRESTRESSING

JOHN M. BUCKLEY, M. ASCE, Consulting Engineer

E. A. VERPILLOT, M. ASCE, Deputy Chief Engineer and Engineer of Construction

Department of Marine and Aviation, City of New York

New York's Pier 57 founded

Drawing heavily on modern engineering science, the designers and constructors of New York's new Pier 57 have developed a structure that will be unique among dockside facilities. The pier proper will stand on two huge reinforced concrete boxes whose load will be carried largely by buoyancy. A third box will support the bulkhead. Sand piles driven into the river bottom serve to consolidate the subsoil. Prestressed concrete stringers will carry the heavy loads imposed on the main pier floor by ship cargoes. Because of limited space at the pier site, the boxes are being built 38 miles up the Hudson, whence they will be floated down to their final destination.

Something new in the field of pier construction is being built to take the place of New York's old Pier 57, North River, which was destroyed by fire in 1947. The new Pier 57 will have no piles with the exception of the relatively few wood piles forming part of the fender system and a small number of composite steel and concrete piles supporting part of the bulkhead structure and acting as dowels to anchor the substructure. This substructure consists of three reinforced concrete boxes. Two of these form the pier proper and the third forms the bulkhead substructure. The design proposes to use the buoyancy of the boxes to carry a large proportion of the dead weight of the pier.

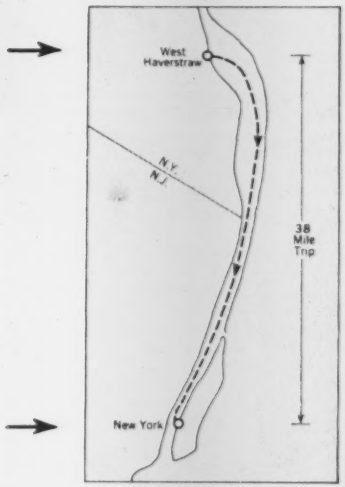
Pier Is T-Shaped

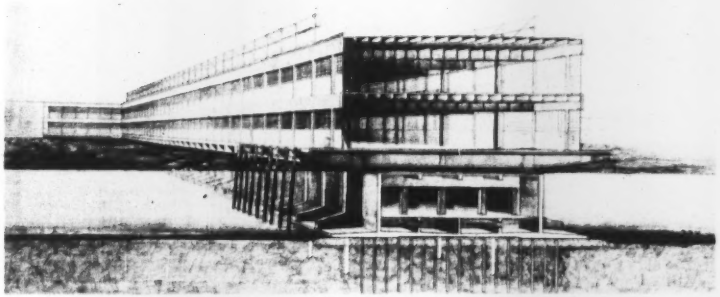
The pier is roughly in the form of a T, the stem, some 725 ft long by 150 ft wide forming the pier proper, and the cap, about 375 ft long by 150 ft wide, forming the bulkhead or headhouse structure.

1. M. & A. field office
2. Contact field office
3. M. & H. field office
4. Contract tool & locker bldg
5. Form fabrication yard
6. Steel fabrication yard
7. Box No. 3
8. Box No. 2
9. Box No. 1
10. Electric gantry crane
11. Steam gantry crane
12. Sump & drainage pumps
13. Concrete batching plant

CONSTRUCTION SITE

Construction site for pouring concrete boxes, at West Haverstraw, N.Y., is some 38 miles north of their final destination at Pier 57, New York City. About 350,000,000 gal of water was pumped out of pond which occupied site before contractors moved in.





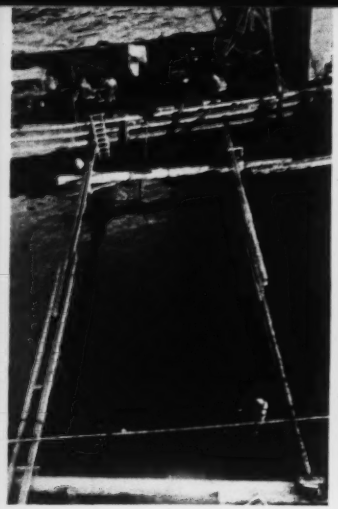
DESTINATION

Completed Pier 57 will rest on vertical sand piles and sand mat. To preserve stability of soil at site, old wooden piles were left in place but were cut off below bottom elevation of pier. Map (above) shows relation of construction site to pier site.

on two 27,000-ton reinforced concrete boxes

On completion, this modern shipping terminal will provide a pier with a two-story shed 120 ft wide having 15-ft aprons on each side. The bulkhead wharf will have a two-story shed 375 ft long and 135 ft wide with a 15-ft apron on the outshore face. Berths 235 ft wide, with a depth of water of 35 ft at low water, will be available on each side of the pier. The main deck consists of precast prestressed concrete stringers, spanning about 20 ft, with a poured concrete topping and wearing surface. The second deck and roof are of reinforced concrete. The shed structures are of steel with practically continuous steel turnover-type doors on both the main and second deck levels. Floors are designed for live loads of 350 psf on the basement deck; 600 psf on the main deck; 450 psf on the second deck; and 100 psf on the roof. The relatively high design live load for the roof contemplates its use for the storage of bulky and relatively light cargo such as automobiles.

Ramps capable of accommodating large trailer trucks, now so extensively used for the transportation of cargo to and from piers, will lead from the street level to the second deck. Freight elevators will operate from the basement level to the roof. In the bulkhead box two additional ramps lead from the street to the basement and provide means for taxicabs, private cars and express baggage trucks to load and unload. Passengers will be able to arrive and depart via this lower level, traveling to and from the second deck on esca-



Piles at pier site for temporary support of bulkhead box are cut off to within ½ in. of desired elevation by precise method. Rectangular frame supported on piles carries horizontal pipe. Chain saw (right) is attached to two vertical pipes which are in turn fastened to horizontal pipe. Depth of saw below horizontal pipe can be adjusted by turnbuckles.

lators and elevators, and their baggage will travel the same route on baggage conveyors. Thus passenger car and taxi traffic is separated from trucks, freeing space at the street level of the bulkhead shed for 14 off-street truck loading and unloading stalls, equipped with suitable platforms and ramps for handling cargo by fork lift trucks.

Besides providing a substructure for the pier and bulkhead superstructure, the boxes will provide a basement area which, with its air conditioning and refrigeration facilities, will be particularly suitable for the storage of perishable cargo. The bulkhead box, besides providing passenger loading and unloading facilities, furnishes space for storage and repair of cargo handling equipment such as fork lift trucks, and space for utility rooms such as transformer vaults and boiler room. The second deck of the bulkhead shed provides passenger waiting room facilities and offices for the shipping company that will occupy and operate the pier. Additional office space is provided on the third floor of the bulkhead shed.

Two Contracts Let

Two major contracts have been let, one for preparation of the pier site at the foot of West 15th Street, New York, and the other for the construction and placing of the boxes. The first contract provides as major items the dredging of the site to a depth of 36 ft below mean low water, cutting off of existing old piles remaining from the burned pier, laying of a 2-ft thick sand blanket over the area on which the boxes are to be placed, driving of 304 sand drains extending 50 ft below the dredged bottom and spaced about 20 ft on centers, and finally, the laying of a gravel blanket 2 ft thick over the site.

In addition to these items, piles for the temporary support of the bulkhead box are to be driven to close tolerances both as to location and cutoff elevation. The bulkhead box differs from the other two boxes in that it has, on the outside, ribs about 42 in. wide and spaced 20 ft apart on centers. The temporary piles for the support of the box must come within the rib widths, and the tops of the piles must provide bearing when the box is set at its proper location and elevation. These temporary piles will support the box until the permanent composite piles have been driven to rock through openings provided in the side walls of the box. These openings will later be concreted in.

The contract also provides for the installation of pore-pressure and earth-pressure cells in the silt for use in investigating the rate of consolidation of the silt, once the sand drains have been completed and the weight of the loaded boxes is brought to bear on the silt.

All items of work in this contract have been completed except for the placing of the sand drains and gravel blanket. The sand drains are about 90 per cent complete. Of course the gravel blanket cannot be placed until the sand drains are completed. No particular difficulty was experienced in dredging the site. Dredging was done by clamshell buckets operating from two floating cranes.

Cutoff tolerance for the piles which temporarily will support the bulkhead box was set at plus or minus ½ in. from the theoretical elevation of 14.3 ft below mean low water. The contractor developed the following method for cutting off the piles. A chain saw operated by a diver was suspended from two vertical pipes, which were connected to a horizontal pipe resting on a wood cap. This cap was supported by temporary wood piles driven just deep enough to secure stability once they were stay-lathed or capped. The vertical pipe was connected to the horizontal pipe through turnbuckles which permitted vertical adjustment of the saw. Horizontal movement was provided by rolling the horizontal pipe along the pile cap. This method was simple and relatively inexpensive and provided the required degree of accuracy since it was unaffected by waves or swells.

Sand Drains Placed Under Water

The contract for placing the sand drains under water required that the drains be formed by driving an 18-in.-dia. open-end pipe to a depth of roughly 50 ft below the dredged elevation of minimum 36 ft below mean low water; that all silt and other material be cleaned out of the pipe; that the pipe be filled with sand before being withdrawn; and that the sand completely fill the hole as the pipe is withdrawn.

The contractor did not anticipate that the pipe would become clogged by old piles remaining from the former structure, and that driving would be relatively difficult in parts of the site. The old wood piles from the former pier were left in place after being cut off at the dredged depth because it was felt that they had previously helped to consolidate the silt and this gain in consolidation would be lost by their removal.

Despite the care taken to locate these old piles, time and time again in the early stages of driving they were found inside the pipe when it was pulled. Since most of the old piles had been lagged with four 4 x 6-in. timbers bolted and spiked to the pile sides, and since in most

cases the piles entered the pipe at an angle, the difficulty of removing them can well be imagined. Generally the only solution was to pull the pipe and cut an opening in it to permit their dislodgement, or to cut the pipe off and salvage the upper part of it only.

Up to a distance of about 250 ft out from the bulkhead, the bottom was so hard that it was practically impossible to detect the location of the old piles. As the driving of the sand drains has proceeded further offshore, it has become easier to detect their location. When a pile is detected, the location of the sand drain is shifted slightly to avoid it. In offshore areas, if the old pile does escape detection and enter the pipe, it can generally be blown out by means of the airlift used to clean the pipe. In the early stages of driving, the pipe was cleaned out hydraulically, but this method proved unsatisfactory and the airlift method was substituted.

To drive the pipe for the sand drains, the contractor is using a McKiernan-Terry 10-B-3 hammer in 100-ft leads on a floating rig. Two compressors, one of 500 cfm and one of 600 cfm, furnish air for cleaning out the pipe. Sand is placed in the pipe by means of an Insley 1½-cu yd concrete bucket. To prevent the sand from coming up with the pipe as it is withdrawn, a cap provided with an air connection is bolted to the top of the pipe and an air pressure of 75 to 100 psi is maintained within the pipe. From time to time while the pipe is being pulled, the cover is removed and soundings are taken to check the elevation of the top of the sand.

A good measure of the size of the project is the fact that each of the two pier boxes weighs some 27,000 tons, contains about 2,000 tons of reinforcing steel, and is roughly 360 ft long, 82 ft wide, and 34 ft high. The walls are about 2 ft thick. The boxes displace about 1 ft of water for each 1,000 tons of weight. The bulkhead box weighs about 19,000 tons and is about 372 ft long, 87 ft wide, and 28 ft high.

Boxes Being Built Up-River

It was realized that the pier site was not large enough for construction of the boxes without interfering with shipping operations in adjacent slips. Even if the adjacent slips were closed to shipping, construction would have been limited to one box at a time, with consequent delay in completing the work. Still further difficulties would have been encountered in delivering and handling materials because of traffic congestion on West Street, which runs parallel with the waterfront and provides the only highway access to the piers on the North River. Therefore it was necessary to find a site which would permit construction of the boxes in the dry and which at the same time would be accessible to the river without excessive dredging and without too many towing hazards. The weight of the boxes and their design precluded the use of launching ways and made site selection still more difficult. A Navy graving dry dock in New York harbor would have been ideal but was not available.

Before this second major contract was advertised, a search was made of the waterfront area within a 100-mile radius of the city for locations that might be suitable. At the time of advertising for bids, some twenty possible sites had been listed. The listing gave the location, ownership, and general characteristics of the property. A map showing the location of the site in relation to the waterways was included. No information was given as to the availability of the site or the terms that might be secured for its use. The notice to prospective bidders was very specific on the latter two points. Bidders were further informed that they were in no way limited to the listed locations, which were furnished

Porous concrete pipe is laid around entire perimeter of construction site and in three lines crossing area. Pipe drains into three sumps

Construction joint of bottom lift is prepared by sand blasting. Although productive of good joints, this method was unsatisfactory because of accumulation of sand inside box. Method of coating forms at adjoining faces with set retardant was then tried. This method, which made it possible to roughen face of joint by hosing, proved as effective as sand-blasting and less expensive.

Ready-mix trucks transport concrete from batching plant to placement site. One gantry crane on each side of boxes places concrete in forms with 2-cu yd buckets.

Reinforced concrete slab 4 in. thick serves as bottom form for two pier boxes. Slab is treated with resinous curing compound to improve curing and prevent adhesion to concrete boxes.

merely to save them time in searching for suitable sites. This procedure was well worth while and undoubtedly saved prospective bidders considerable time and trouble.

The successful bidder chose one of the sites listed, a pond about 2,100 ft long and 650 ft wide with depths ranging from 25 to 42 ft, located on the west side of the Hudson River between West Haverstraw and Stony Point. Many years ago it had been a clay pit used in the manufacture of bricks. A narrow embankment about 75 ft wide separates it from the Hudson River.

Pumps Dewatered Site

Four 10-in. centrifugal pumps operating around the clock dewatered the site in three weeks, pumping out 350,000,000 gal. About 150,000 cu yd of mud, clay and silt were then removed to obtain a suitable subgrade. In the south and central areas an outcrop of hard red sandstone was unexpectedly encountered and had to be blasted out to reach grade. About 1,000 cu yd of rock was removed in these areas, where the two pier boxes are at present being constructed.

At the northern end, where the bulkhead box is being constructed, the site consists partly of rock reaching to the surface and partly of deep pockets of clay and silt. The bulkhead box differs from the other boxes in that it has heavy ribs running transversely across the outside. Since these ribs cause heavy concentrations of load, wood piles had to be driven in the soft areas to furnish the additional support needed. The rest of the area was backfilled with crushed stone, gravel, and quarry tailings.

A complete drainage system was placed around the periphery of the bottom of the pond and across its width at three points. The drains, of perforated concrete pipe, empty into three sumps from which the pumps originally used in draining the pond remove the seepage. The system has kept the area free of water at all times.

To finish the site where the two pier boxes were to be cast, a 6-in. layer of bank-run gravel was placed, and on it a 4-in. slab of reinforced concrete was poured to serve as the bottom form for the boxes. The surface of the slab was treated with a resinous curing compound to assist in curing and to prevent adhesion of the boxes to the slab.

A modern batching plant capable of weighing two types of coarse aggregate, as well as fine aggregate, cement, water and admixtures, was constructed near the northeast end of the site. Local aggregates were generally found to be unsuitable for the type of concrete required for the boxes. Specifications require 5,000-lb concrete in 28 days. After numerous tests of various mixtures of aggregate from both local and Long Island sources, a combination of trap rock from Haverstraw, N.Y., and gravel from the Port Washington, Long Island, N.Y., area, some 60 miles distant, was finally selected for the coarse aggregate. Broken stone could not be used exclusively as coarse aggregate because it provides a relatively harsh mix, requiring an excess of water to obtain the flowability necessary in the many areas of congested reinforcement.

Cowbay sand from Long Island and Type II portland cement from both the Lehigh Valley, Pennsylvania, and the Hudson Valley, New York, completed the mix. From 4 to 6 percent of air entrainment is provided through the use of Darex. For better workability an admixture of Plastiment is included.

Pouring in Cold Weather

Since much of the pouring has had to be done in cold weather, at temperatures below 32 deg F, winter protection is provided by heating both aggregates and water. Where the pour is in progress, steam jets and tarpaulin enclosures are also used. Salt hay covered by tarpaulins is used for curing slabs on the ground. Temperatures between 50 and 60 deg F are maintained for a minimum period of five days after pouring.

Concrete is transported from the batching plant to the placement site in ready-mix trucks, which were carefully inspected before being accepted for use on the project. New blades were placed in the mixing drum, and revolution counters and other improvements were added to insure satisfactory mixing and control. Once the trucks are accepted they must remain at the site for the duration of the work. They cannot be diverted to other projects until

Steel fabrication yard is located at south end of construction site. Reinforcing is prefabricated into large sections on special jigs and set in form boxes by gantry cranes.

construction is completed. Concrete is mixed for a minimum period of 12 minutes. Actual placement in the forms is by 2-cu yd buckets suspended from gantry cranes operating on tracks on each side of the boxes.

Preparation of Adjoining Faces

Pouring of concrete for the boxes is accomplished in seven lifts of six sections, each requiring about 500 cu yd. Originally the face of previously placed concrete, against which the next pour was to be made, was prepared by sand blasting. This method, although it provided a good surface against which to pour, left large deposits of sand in the poured sections of the boxes. Removal of this sand involved excessive labor and difficulty. Therefore the sand blasting method was discontinued, and instead a set retardant, form-coating compound is used on faces against which pouring is to be continued.

This coating retards the set of the outer 1 or 2 in. of the concrete, which can be washed off by hosing within 24 hours after placing. As far as exposure of aggregate and provision of a good surface for bond are concerned, the results are as good as, if not better than, those secured by sand blasting. Before the next pour is placed, the joints are heated by steam jets to about 70 deg F for a period of 12 hours. The joints are then coated with a 1:1 mortar mix before the new concrete is placed.

At the southern end of the construction site is the steel fabrication yard, equipped to fabricate 500 tons of reinforcing steel a week. Reinforcement is prefabricated into large sections on steel jigs, and set in the box forms by gantry cranes. Much of the reinforcing must be welded rather than lapped. Welding is done by the "submerged melt" process, which makes use of a metal mold and a granulated material beneath which the electric welding takes place. This process has proved to be economical, fast, and productive of high-strength welds.

The prestressed concrete stringers for the main deck of the pier will be fabricated at the Haverstraw site according to present plans. The stringers are 191 ft long and are roughly I-shaped in cross section, with a top width of 14 in., a bottom width of 18 in., and a depth of 12 in. Each stringer contains 30 wires of 0.192-in. diameter, which have an ultimate strength of 240,000 psi and a working stress of 160,000 psi at the end of 7 days.

Two prestressed stringers in all respects like those to be placed in the structure were constructed for test purposes and underwent extensive load tests to destruction. They were complete with the 4-in. concrete topping so that the actual stresses, deflections, creepage, and slippage could be compared with the theoretical. The test results have not yet been fully tabulated and analyzed but the following observations can be given:

1. With dead load only, there was no deflection in the stringer.
2. With the application of the equivalent of the working load—dead load plus a live load of 600 psf—there was a deflection at the center of the stringer of 0.075 in.
3. With the application of the equivalent of 3½ times the working load, there was a deflection of 0.343 in., and the first crack appeared.
4. With the application of the equivalent of four times the working load, the deflection at the center was 0.625 in., and numerous cracks appeared in the stringer.
5. With the application of about five times the working load (actually it was extremely difficult for the jacks to maintain the equivalent of five times the working load because of the continued deflection of the stringer, and 4¾ times the working load would probably be a more accurate statement), deflection reached 4.75 in., and failure occurred. After the load was removed there was a recovery of about 3 in. A rather surprising fact was noted—that there was no separation between the topping and the stringer until ultimate failure was reached, and although, because of the deflection, the end supports provided only line bearing, there was no failure of the concrete at these points.

Status of Work

It was planned that the construction of all three boxes would proceed simultaneously, but because of the foundation difficulties encountered at the construction site of the bulkhead box, work on that box has been delayed. Work on the other two boxes is proceeding, and up to the middle of February both the first and second lifts of concrete had been placed on one of the pier boxes and

Prestressed concrete stringer exactly like those to be placed in structure was tested to destruction. Beam failed at five times working load. Steel with ultimate strength of 240,000 psi and 5,000-psi concrete were used.

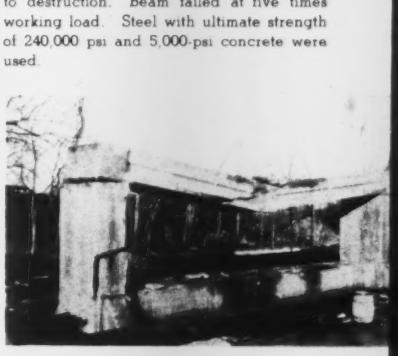
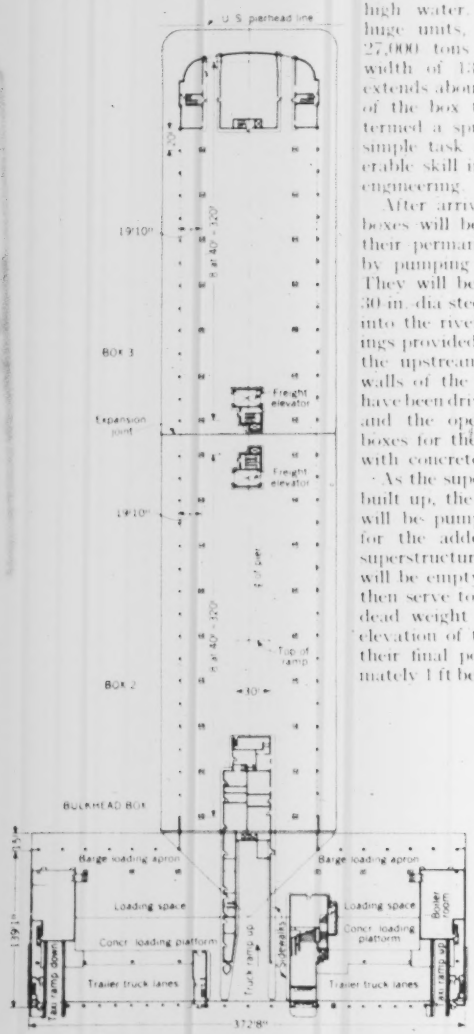


FIG. 1. First floor plan of Pier 57 shows street loading facilities for trucks. Taxis use ramps adjacent to truck loading platform to reach basement level, where they pick up and deposit passengers. Conveyor belts move baggage from floor to floor, and elevators convey passengers from basement to second floor in bulkhead structure. Ramps for trucks are provided from street to second deck of pier. Two freight elevators move cargo from basement to roof in pier proper.



the first lift of the other pier box was well along. Altogether, as of February 15, more than 4,000 tons of reinforcing steel and 12,000 cu yd of concrete have been placed.

When the boxes are completed, water will be readmitted to the site and the pond refilled. When the boxes are afloat, the dike will be breached, a channel dredged to deep water in the Hudson River, and the boxes towed down the river to the pier site in New York City. Towing will have to be carefully timed to avoid grounding as there are several places where the depth required for clearance can only be obtained at high water. The towing of these huge units, each weighing roughly 27,000 tons and having a bottom width of 130 ft (the bottom slab extends about 25 ft beyond each side of the box to form what might be termed a spread footing) will be no simple task and will require considerable skill in seamanship as well as engineering.

After arrival at the pier site, the boxes will be carefully spotted over their permanent locations and sunk by pumping fresh water into them. They will be held in place by large 30-in.-dia steel dowels or piles, driven into the river bottom through openings provided at 40-ft intervals along the upstream and downstream side walls of the boxes. After the pipes have been driven and cleaned out, they and the openings provided in the boxes for their passage will be filled with concrete.

As the superstructure of the pier is built up, the water within the boxes will be pumped out to compensate for the added weight. When the superstructure is completed, the boxes will be empty. Their buoyancy will then serve to carry 86 percent of the dead weight of the structure. The elevation of the top of the boxes in their final position will be approximately 1 ft below mean low water.

To carry the prestressed concrete stringers and deck, huge reinforced concrete cross beams will be cast on top of the boxes, spaced about 20 ft on centers. Schedules call for placing the boxes, ready to receive the superstructure, by the early summer of 1952.

Contracts to Be Let

It is expected that contracts for the pier shed, fender system, heating, lighting and cargo hauling equipment, will be placed this spring. The cost of the completed pier is estimated at $10\frac{1}{2}$ million dollars.

The outstanding feature of this pier is its relatively large amount of storage space in proportion to its size. Covered storage amounting to more than 360,000 sq ft will be provided in addition to about 80,000 sq ft of open storage space. This, together with ramp approaches, off-street loading facilities, and the adaptability of the basement areas for storage of perishable cargoes, will make it one of the most efficient shipping terminals in the Port of New York, if not in the world. It has several other advantages, namely, a high degree of fire resistance, freedom from the attack of marine borers, and a long structural life at low maintenance cost.

The pier was designed for the Department of Marine and Aviation of the City of New York by Capt. E. H. Praeger (CEC, USNR), M. ASCE, partner in the New York firm of Madigan-Hyland, consulting engineers on the project. The Hon. Edward F. Cavanagh, Jr., is Commissioner of the Department; John M. Buckley, A.M. ASCE, is Consulting Engineer; Capt. L. H. Rabbage, USNR, Chief Engineer; and Capt. E. A. Verpillot (CEC, USNR), M. ASCE, Deputy Chief Engineer and Engineer of Construction.

At the Haverstraw site, the Resident Engineer for the Department of Marine and Aviation is R. C. Wood, and for Madigan-Hyland, C. R. Barrett. Leonard E. Ott is the project manager for the contractors. At the New York City pier site, Charles Dilberger is Resident Engineer for the Department of Marine and Aviation, and James Bruschi for Madigan-Hyland.

Contractors for the preparation of the pier site in New York are O'Brien Brothers, Inc., and Quist Construction Co., Inc., joint venturers. Contractors for the construction and placing of the boxes are Merritt-Chapman-Scott Corp., Inc., and Corbetta Construction Co., Inc., also acting as joint venturers.

What about the next hundred years?

JOSEPH H. EHLERS, M. ASCE, Field Representative, ASCE, Washington, D.C.

The dawn of ASCE's centennial year of 1952 finds the engineer in the spotlight as the central figure in a magnificent century of technological achievement. The first hundred years of organized engineering in the United States is ending in a blaze of technical glory and in a maze of vague aspirations for improving our social and economic system. The centennial year is a convenient milestone from which to survey the accomplishments of the past and to chart a course for the future. ASCE has been broadening its viewpoint and its range of activities gradually in recent years, but the century mark is a convenient point for regrouping our forces to carry on the work with renewed enthusiasm.

Here in the nation's capital there are several major fields of interest to the profession. Among them is the legislative department of the government. In the past few years several pieces of legislation which directly affected engineers were modified to reflect the views of the profession, as a result of cooperation by the Society with Congressional committees. Regardless of whether it is the function of ASCE or of some other technical group to deal with legislative matters, all engineers should place their knowledge and experience at the disposal of Congressional committees when matters of interest to the profession are under consideration.

A national water policy has been proposed by Engineers Joint Council. Engineers of prominence will volunteer to assist Congress in evolving a sound water policy, not alone because they are skilled in the planning of projects but because they are competent to discuss expertly the social and economic consequences of such construction.

Actions of the federal executive departments must also be followed carefully. New regulations of the utmost importance to the practicing civil engineer concerning materials controls, prices and salaries are issued periodically. With the production of military goods in 1952 expected to double that of 1951, shortages of critical materials are leading to further restrictive regulations on non-defense building, concerning which we must advise the Government and inform our membership. Salary regulations and Civil Service matters merit special attention, for many thousands of our members are salaried employees in private firms and in state and federal employ.

Another important task relates to the organization and operating problems of the construction industry that great segment of American economic activity which ranks so high in the national economy. ASCE has helped to provide leadership in the efforts of the whole industry to effect some form of organization and to mold an industry opinion. ASCE representatives have actively participated in analyzing the basic economic problems confronting the industry by their work in such groups as the Construction Mobilization Committee of the U.S. Chamber of Commerce and the Construction Industry Advisory Council. Joint cooperative committees with the Associated General Contractors and the American Institute of Architects are providing direct contact between engineers, architects and contractors.

Nor do Society activities in Washington ignore technological developments. Technical Division committees particularly have vital interests here. With the enormous organization and vast research facilities of the Government in the military field, in atomic energy, in reclamation, and in other important engineering fields, Washington has become the technological capital of the nation.

Two broadened activities in which the engineer has made real headway and on which he must place more emphasis in the future are engineering economics and technical administration. Progress is being made in supporting our contention that engineering enterprises can best be administered by trained engineers, not only because of their knowledge of the specific business but also because engineering training is in itself an excellent developer of managerial talents.

Now that the profession is at the portal of a broader and more comprehensive development, its organizations must look forward to increasingly active and important service. The membership of about 140,000 professional men in the societies constituting Engineers Joint Council, of whom 34,000 are ASCE members, includes not only many high administrators and government officials but also many versatile men with dual training including law, economics, business management, accounting, and even politics.

Key committees to spearhead these broadened activities are found in ASCE's National Affairs Committee and EJC's National Engineers Committee. A Committee on Unity is laying the foundations for increasing the number of organizations participating in such work.

Instead of a letup in the hectic pace of technological development which might have permitted social evolution to reach a parallel stage, the engineering profession's new century dawns with the infant atomic energy industry crying for new worlds to conquer, presaging more rapid and more unpredictable technical advances than have taken place in any previous century. The structure of society in America must inevitably be brought into line, and the engineer must apply to this problem the same powers of analysis and ingenuity and marshaling of resources that have enabled him to make his technological advances. In this vastly significant year let us not only commemorate the memorable century of engineering achievements just past but also firmly resolve, in the years to come, to make the influence of the engineer more strongly felt in public affairs, in the community and in the nation.

Highway

Clearing of right-of-way, although first step in construction, must be preceded by carefully prepared engineering plans. Here right-of-way near Bremerton, Wash., is cleared by Caterpillar D7 bulldozer.

Improvement of America's highways to desired standard would cost 41 billion dollars, according to report of Joint Committee of Congress several years ago. Relocation of highway near Redding, Calif., here shown, eliminated 50 curves and widened roadway. Photo by Caterpillar Tractor Co.

Base stone coarse is rolled by Savin Construction Co. after application of penetration asphalt on 118-mile New Jersey Turnpike. Even with Turnpike a reality, present estimates place state's new highway construction needs at nearly a billion dollars.

Machines do initial work of smoothing concrete pavement on New York State Thruway north of Syracuse. At present New York State has about 30 consulting firms assisting in preparation of plans for highway projects.

To bring the nation's highways up to the required standard, a tremendous planning and construction job must be carried out. This undertaking will be a challenge both to the civil engineering profession and to the construction industry. In nearly every section of the country traffic problems are worse today than they were ten years ago. At many locations the problem is extremely critical and is causing great loss of life, property, and travel time.

To improve America's highways to the desired standard would cost 41 billion dollars, a Joint Committee of Congress reported several months ago, following an intensive study of the problem. Improvement needs of the 664,464 miles of federal-aid highways under supervision of the state highway departments as of December 31, 1951, totaled slightly above 32 billions, according to a survey recently completed by the American Association of State Highway Officials. Other groups place the construction needs on all roads of the United States, which total over three million miles, at between 40 and 50 billion dollars.

In 1949 the Bureau of Public Roads, after a study made as part of the national defense program, placed the cost of bringing the 37,800-mile strategic Interstate System up to the desired standard at 11.3 billions. And this applies to only 37,800 miles of highways which connect our major cities.

If all the cars and trucks produced in the United States in 1950 were placed bumper to bumper, the line would extend nearly 20,000 miles. Car production in 1951 dropped somewhat, or to 5,300,000 as compared to 6,750,000 in 1950, but truck output rose to 1,400,000, or considerably above the 1950 production of 1,300,000.

contractors study the big job ahead

ARCHIE N. CARTER, A. M. ASCE, Manager, Highway Division, Associated General Contractors of America, Inc., Washington, D.C.

At the end of 1951, some 52,200,000 motor vehicles were registered in the United States, according to the U. S. Bureau of Public Roads. Truck registration now exceeds 9,100,000 units, compared with 4,850,000 at the peak of World War II, and motor busses total about 230,000. Last year the net gain in vehicle registrations of all types was more than three million units. The most recent issue of *Automobile Facts* reveals that in 1949 trucks transported 8.3 billion tons of freight over America's highways, or three times as much tonnage as was moved in the United States by railroad, water, and air combined.

In 1948 there were 32,259 people killed on our highways. In 1949 the slaughter was reduced to 31,500. But in 1950 it jumped to 35,500 deaths, and 1,799,800 additional persons were injured. Final figures as to traffic deaths are not available for 1951 but the total is estimated at 37,500 deaths, which would be an increase of one third since 1945.

Total gasoline consumption and total miles of travel hit new highs in 1949 and again in 1950, and soared still higher in 1951. Other staggering figures could be cited to illustrate the large road construction task we now face.

But my purpose here is to discuss methods to make the highway construction of the next few years most effective to consider how we can bring up to date our most basic form of transportation, which today is a 30-billion-dollar industry employing 9,000,000 people and representing one-eighth of the national income. How can we secure maximum benefit from each dollar spent for highway construction?

Long-Range Plans Come First

The first step is the preparation of comprehensive plans by the state highway departments and local governmental agencies. These must be long-range plans outlining construction programs for several years ahead. In the preparation of these plans the most capable highway engineers in the country must be employed by the highway departments. And to secure such men in adequate numbers the states and local agencies must pay better salaries.

For the past several years the Joint Cooperative Committee of the American Association of State Highway Officials and the Associated General Contractors has been working on this salary problem. But all engineers as well as all segments of the contracting industry must strive for better salaries for highway engineers if the huge construction task ahead is to be planned properly.

ASCE Also Helps

The Joint Cooperative Committee of the American Society of Civil Engineers and the AGC, which was organized in 1948, also is at work on the problem of securing better salaries for civil engineers and of providing better training for those engaged in construction. This committee is striving to increase the usefulness of the ASCE Student Chapters in the engineering colleges. Many AGC chapters are assisting in the program. The Joint Committee also plans to help in providing summer employment for student engineers and in getting more engineer graduates to enter the highway construction field. Such activities should aid greatly in overcoming the severe shortage of engineers in highway work.

Many states as well as county and municipal highway departments may need to employ outside consultants who are specialists in the highway field, both to make long-range studies and to prepare detailed engineering plans. Such consultants can also design many special structures, thereby reducing the peak load on the engineers in the state highway departments. For example, New York State at the present time has about 30 consulting firms assisting on the preparation of plans for highway projects.

Numerous states, including California, Colorado, Idaho, Illinois Iowa, Kansas, Maine, Michigan, Minnesota, Mississippi, Nebraska, New Hampshire, Oregon, Ohio, Vermont, Virginia, Washington, and others, have already completed long-range plans. Additional states have studies in progress.

Some advantages of a long-range plan are that:

1. It promotes a better understanding of the state's highway needs by the state highway department itself.

2. It simplifies the problem of selling the public on financing the big job to be done.

3. It permits acquisition of the required land on schedule and at lower cost.

4. It stimulates the interest of contractors, with the result that more and better bids are received.

5. Better engineers can be employed, for they will be assured that employment with the state highway department can last for several years.

6. Production of the necessary construction materials will be stimulated since the needs thus outlined will encourage producers to make the large investments that may be involved.

7. A big financial saving on the entire construction program will result.

Diversion of Funds Must End

The second big step in meeting the nation's highway construction needs

is to find means of financing the work. One way of doing this is to terminate the present harmful practice of diverting gasoline taxes and other highway-user revenues to non-highway purposes. During the years 1924 to 1950 inclusive, such diversion totaled over three billion dollars. In 1950, the last year for which detailed figures are available, the diversion for the entire country totaled 217 million dollars, and eight states diverted more than 10 percent of their highway revenues. (In comparison, in the calendar year 1951, about 1.4 billion dollars of new road construction was awarded by the state highway departments.) Stated in another way, diverted highway taxes in recent years were sufficient to improve nearly 100,000 miles of highways, according to a report from the Highway User's Conference.

Diversion can be stopped effectively only by the passage of anti-diversion amendments by state legislatures. Already the following 21 states have constitutional amendments which conserve highway revenue for highway purposes:

California	Massachusetts	Ohio
Colorado	Michigan	Oregon
Idaho	Minnesota	Pennsylvania
Iowa	Missouri	South Dakota
Kansas	Nevada	Texas
Kentucky	New Hampshire	Washington
Maine	North Dakota	West Virginia

The support of the general public must be secured to back the drive for such laws in the remaining states.

In the calendar year 1951 the legislatures of Alabama and Georgia passed anti-diversion amendments; these laws will be placed before the voters in 1952 for final approval. Several states are expected to vote on similar measures this year; in Arizona, New Jersey and New York proposed laws already have been introduced.

Many States Increase Taxes

Since 1945 there have been increases in state gasoline taxes in 31 states and the District of Columbia. In many of these states comprehensive long-range studies of highway needs had been made and proved extremely helpful.

Those seeking to finance large highway construction programs received a valuable aid in July 1949 when the Brookings Institution released a comprehensive report on the highway problem. The Institution found that if the per-mile cost of automotive transportation is to be reduced to the lowest possible level, a greater proportion of the automotive transportation dollar must be devoted to improving the overburdened highways. Today only 5 to 10 cents out of every dollar spent for automotive transportation is applied to the provision of highways, the remaining 90 to 95 cents being spent on vehicle maintenance, gasoline, and other operating costs, the study revealed. This investment in highways was described as so small as to be completely illogical and out of line with other automotive costs.

The Brookings report concludes:

> The logic of this division of the highway transportation dollar appears highly questionable wherever the highway system is inadequate, since the excessive cost of the vehicle may in large part result from this inadequacy. Paying less for highways may mean paying more for highway transportation. What we save in highway expenditures we may lose in higher operating costs, with lower standards of service the net result.

Results of the Brooking Institution study were made available in July 1949 when the book, *Automotive Transportation Trends and Problems*, by Wilfred Owen, was released.

Congress Considers Increased Aid

In February the Congress started hearings on a new federal-aid highway law. In their testimony, representatives of the American Association of State Highway Officials asked that federal aid for highways be increased to $10 millions annually because of the deplorable condition of America's highways and because of the great importance of adequate transportation to our national economy and to national defense. Under the present law, federal aid is limited to 500 millions yearly.

Representatives of the AGC in testifying at the hearings have stressed:

1. Highway construction costs are in line with the prices of other services and commodities, so that full value is assured for the investment in highways. Evidence that state highway departments are getting good bids is the fact that 99 percent of the national volume of federal-aid highway construction during the past five years has been done by the contract method.

2. The keen competition prevailing and expected to prevail in highway construction is assurance to the general public that the construction will be executed as efficiently as possible.

3. The highway contracting industry has the capacity to carry out an expanding highway construction program, and to do the work economically.

4. Major factor delaying highway work is the relative small amount of steel allocated to highway construction and the numerous projects delayed by slow steel deliveries.

5. Highway contractors, through their local AGC chapters and the national association, are cooperating with highway departments in practical means of increasing the efficiency of construction operations.

The Challenge of Construction

After comprehensive planning and financing comes the actual construction, the third big step toward meeting the country's highway needs. It is at this point in the program that the importance of clear specifications and sound plans becomes especially evident. Highway engineers must prepare plans and specifications that tell the contractor clearly what is to be done while leaving him free to choose the equipment and methods he considers the most satisfactory for doing the work. In other words, highway engineers should specify results, not methods.

It is assumed that construction will be by contract. This method is favored for the following reasons:

1. Cost of the project is fixed before construction starts.

2. Quality is guaranteed in accordance with the plans and specifications.

3. The general contractor has the financial incentive to complete the project on schedule.

4. The lowest possible cost is secured through free competition among competent general contractors.

5. The detailed planning required before bids can be taken assures a properly planned project.

6. Responsibility for construction is centralized in the general contractor for maximum efficiency.

7. Greater economy and speed are secured than can be obtained by any other method. Experience has repeatedly demonstrated that this is the case.

Prompt Pay to Contractor

The highway contractor's investment is huge and his financial responsibilities are severe. Therefore he should be paid promptly as the work proceeds. Contractors stress the fact that prompt payment is only good business and brings major benefits to all concerned. Contractors also consider it highly desirable that much less be retained by state highway departments on partial payments.

Numerous contractors report that their state highway departments

would benefit in the long run if they would retain but 10 percent on partial estimates, until 50 percent of the work is complete, and thereafter only 5 percent of the partial estimates. Several states long ago saw the advantages of this procedure and adopted it. Other highway departments have adopted even better procedures.

A new contract in use by the Rural Electrification Administration contains a provision calling for payment of interest to the contractor if he is not paid promptly for work completed. Such a plan might be beneficial on highway construction.

Other Efficiency Methods

Other ways to speed up highway construction, in the view of the contracting industry, include:

1. Permit the contractor free use of new types of equipment.

2. Be sure land is available and the job ready for the contractor to move in and start work when bids are opened.

3. Use local construction materials to the maximum. This will also reduce costs.

4. Cut hand labor to a minimum.

5. Award contracts of various sizes to permit both the small and the large contractor to participate.

6. Work for greater standardization of design to permit, for example, the savings realized when a contractor can use the same type of bridge forms in neighboring states.

7. Lengthen the construction season by having lettings as early as possible to permit maximum use of the contractor's equipment and personnel, and thereby get lower prices.

8. Aim for a balanced construction program each year.

To illustrate the last point, if a highway department has a large volume of black-top work one year and none the next, it will be difficult for the construction industry to keep in step, and higher prices will result.

Because of the present uncertainty as to the supply of some types of building materials, such as steel, the AGC favors the use of a clause in highway contracts to permit their termination if an all-out war develops and some types of construction must be shut down. On numerous jobs suspended because of World War II, contractors were required to complete work that had been suspended for several years, at a time when prices for both labor and materials had risen much higher than had been anticipated when the contracts were let. Highway contractors prefer the use of a termination clause permitting cancellation of the contract and payment to the contractor for work already completed. Such a clause can be expected to aid in securing lower bids.

The wisdom of using a termination provision in contracts today is recognized by the following states, which use such a clause: Arkansas, California, Colorado, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Michigan, Minnesota, Missouri, New Hampshire, New York, North Dakota, Ohio, Oklahoma, South Dakota, Utah, Wisconsin, Wyoming, and the Territory of Hawaii. Also, to legalize the use of this contract provision, special laws had to be passed in five of these states: California, Iowa, Kansas, New York, and Utah.

Public Relations Important

If any highway construction program is to be successful, the general public must be made aware of the extensive know-how required to carry out such projects. The public must be better informed than ever before if it is to appreciate the great effort being made by the engineering profession and the construction industry to improve America's highways. To accomplish this, highway engineers and contractors alike must greatly improve their public relations programs. They must not only build and improve the highways but they must sell the general public on the great importance of this work to our country.

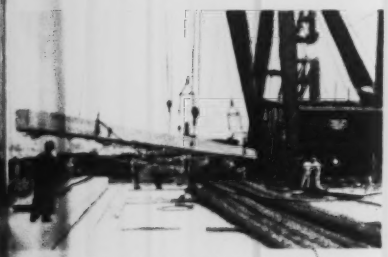
To conclude, as has often been said, we are paying for better roads whether we have them or not. This fact was forcefully illustrated by Commissioner Thomas H. MacDonald, Hon. M. ASCE, of the Bureau of Public Roads, when testifying in February before the Congress on the federal-aid highway bills. At that time he made available the following summary of motor-vehicle accident data compiled by the National Safety Council for the years 1945 to 1950, inclusive:

1. **Number of accidents** increased 51 percent, from 5.5 million in 1945 to 8.3 million in 1950.
2. **Number of non-fatal injuries** increased 20 percent, from 1.0 million in 1945 to 1.2 million in 1950.
3. **Number of deaths** increased 25 percent, from 28,076 in 1945 to 35,000 in 1950. The preliminary estimate for 1951 is 37,500 deaths, an increase of one-third since 1945.
4. **Property damage** increased 92 percent, from $650,000,000 in 1945 to $1,250,000,000 in 1950.

On Kentucky highway job, contractor, W. C. Snider of Danville, uses Lorain 80 shovel to load Athey wagon hauled by Caterpillar D7 tractor to move rock out of excavation. Despite rising costs of equipment, keen competition assures public will get full value for highway construction dollar.

Complicated structures require close cooperation between engineer and contractor. This 3-level structure passes main street of Woodbridge, N.J. (top) and Garden State Parkway over New Jersey Turnpike.

Steel bracing frame for flanking piers was erected on south shore of site and floated out to pier site. Reinforcing for concrete piles may be seen to left of bracing frame prior to casting of piles.



Huge concrete pile is lifted from casting yard by floating crane. Longer piles required four lifting points.

Battered piles were driven at points where expansion joints of bridge deck occurred. Batter was set by use of simple timber templates which were temporarily fastened to previously driven vertical piles. Photo below shows decking in place on capped piles.

Atlantic Beach Bridge

supported on 90-ft

Summer residents of Long Island's resort town of Atlantic Beach will pass over Reynolds Channel on a new structure on their seasonal migration this coming spring. The new double-leaf bascule bridge, with its 153-ft main span, will carry six lanes of traffic, replacing the three-lane double-leaf bascule at the same site which growing traffic has made obsolete. When closed, the new bridge gives marine traffic 13 extra feet of vertical clearance—28 ft as against 15 ft at mean high water.

The new structure is financed by $2\frac{1}{2}$ percent, 25-year revenue bonds totaling 6.3 million dollars.

Designed for an H20-44 loading, the bridge has reinforced concrete decks over the approach spans and steel grating on the bascule leaves. Six north approach spans each 55 ft long, eight south approach spans of the same length, two flanking spans of 75 ft each, and the main span of 153 ft make up the total length of 1,073 ft from center to center of abutment bearings. The approach spans rest on pile bents, and the flanking spans and bascule rest on concrete piers (Fig. 1). About 600,000 cu yd of hydraulic fill was placed for the toll plaza and approaches. An administration building and a toll plaza consisting of ten booths and eleven traffic lanes are also part of the contract.

Each leaf of the structure is powered by two 40-hp motors for the normal drive and one 20-hp motor for the emergency drive. Electric thrustor brakes are used, there being two machinery brakes, two motor brakes, and one brake on the emergency drive for each leaf. Power is supplied by the Long Island Lighting Co. through two service lines, one at each end of the bridge. The total moving load for the south bascule leaf is 816 tons, and that for the north leaf is 866 tons. Both figures include the counterweight.

The substructure for the approaches consists of 2 × 2-ft precast concrete friction pile bents, with batter piles in three of the bents. The piles, some of which were as long as 90 ft and weighed 30 tons, were cast on the south shore of the channel and floated out to the driver on barges. Initial penetration was accomplished by two 4-in. jets using 1,000 gpm each. The piles were then driven to a minimum bearing of 60 tons using a McKiernan-Terry 8S hammer with a striking energy of 26,000 ft-lb. A special anvil was designed for the hammer to protect

Constantly expanding traffic volume made old Atlantic Beach Bridge (background) obsolete. New six-lane double-leaf bascule, with 153-ft main span, provides greater horizontal and vertical channel clearance besides accommodating greater traffic volume.

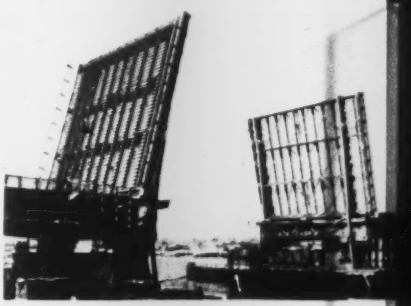
LLOYD I. MONROE

Resident Engineer, Hardesty & Hanover, New York, N. Y.

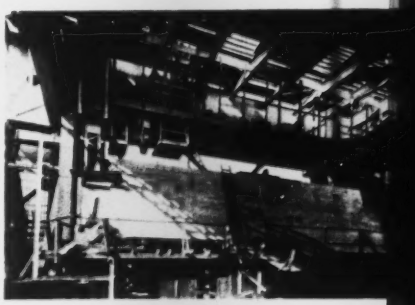
THOMAS C. BARNETT, J. M. ASCE

Construction Engineer, Frederick Snare Corp., New York, N. Y.

piles weighing 30 tons



Open leaves of bascule await installation of power and braking machinery prior to initial closure and adjustment.



Counterweights of bascule leaves are reinforced concrete blocks. Each leaf is powered by two 40-hp motors.

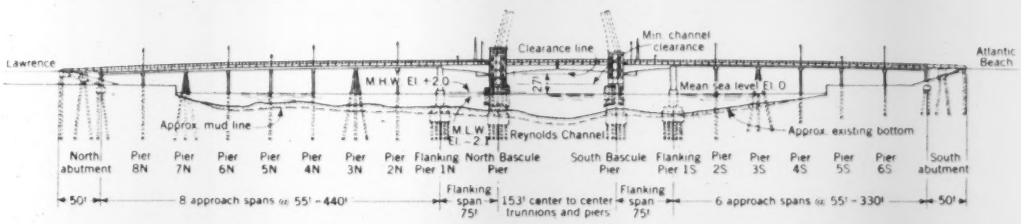
the projecting reinforcing. A reinforced concrete cap was poured on top of the piles after driving had been completed.

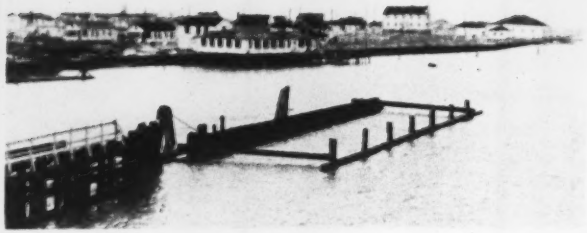
The bascule piers and flanking span piers rest on about 23,000 lin ft of untreated timber piles, each about 25 ft long, which were driven in 40 ft of water with submarine leads and hammer. The method of constructing the bascule piers involved driving a line of sheeting along the shore side of the pier and a row of pin piles along the outer, or channel side. Wayward barges found these pin piles an easy target, and the contractor had to replace them more than once.

The steel bracing frame for the cofferdam was erected on shore and floated out to the pier site on a barge. At the site the entire frame, weighing some 70 tons, was lifted by a floating crane and lowered into position. The frame was hung from the sheeting on one side and from the pin piles on the other side. Driving the remaining sheeting was then completed. A tremie seal was poured, 1,719 cu yd in the north bascule pier, and 1,633 cu yd in the south bascule pier, and the cofferdam unwatered.

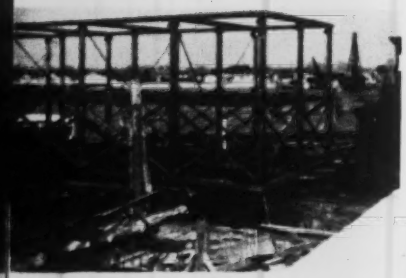
Concrete was produced at a nearby plant and delivered to the site in ready-mix trucks. For the bascule piers, the trucks were driven out to the pier over a timber trestle and a 240-ft car float. The concrete was dumped into hoppers, which in turn were picked up by floating rigs and

FIG. 1. New Atlantic Beach Bridge provides six traffic lanes and enlarged clearances.





Steel sheeting and pin piles are driven prior to placing of bracing frame for bascule pier. Wayward barges caused contractor frequent headaches.



Bracing frame for bascule pier was erected on shore and floated to pier site. Frame weighing 70 tons was handled by single crane.

Bracing frame hangs from steel sheeting and pin piles. Steel sheeting for remainder of cofferdam was next driven and pin piles were pulled. Cofferdam was tremie sealed, unwatered, and pier was poured in the dry.

dumped. In pouring the seals, the bottom of the tremie pipe was closed with a wooden plug wrapped with burlap. When the tremie pipe was lifted, the weight of the concrete forced out the plug and the pour was made. The depth of the seal was 15 ft.

The procedure for pouring the flanking piers, except for one feature, was similar. The bracing frame for the sheetpiling was designed with the horizontal bracing placed diagonally across the corners. This permitted the square column of the pier to be poured up to an elevation above water without running into the bracing, and the frame could then be lifted over the top of the pier and reused. The seal for each of the flanking piers required 310 cu yd of concrete and was 14 ft deep.

Each of the concrete piles is faced with treated timber planking, and timber fenders protect the bascule piers. Timber pile dolphins, seven piles to the cluster, were driven upstream and downstream from each bent.

Steel for the land approach spans at both ends was erected by a truck crane. All remaining approach spans and the two flanking spans were erected with 40-ton stiff leg derricks mounted on the previously erected spans.

With a derrick standing on a live-load anchorage girder, each trunnion girder was picked up from scows and set on a temporary steel tower, and on jacks and blocking on the bascule pier. Using a derrick boat, the bascule girders, weighing 64 tons each, were picked up and set with their tail ends bearing on the live-load anchorage girders, with jacks and blocking supporting the girders at the trunnion point. Next, the trunnions were inserted as far as possible and pulled to final position by means of a specially designed threaded rod. The girders were then rotated into the open position by the derrick, and shored and guyed into position. Finally, the remaining steel was filled in, with the girders in the open position.

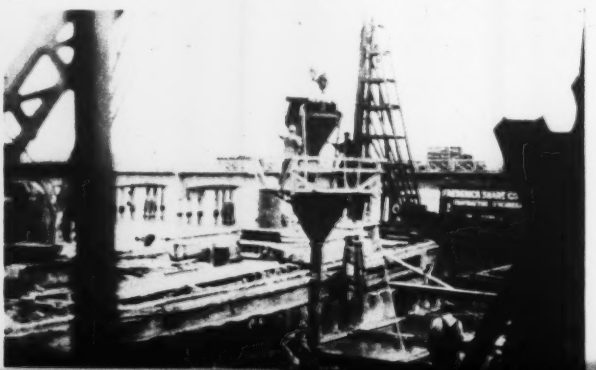
The concrete deck for the south approach was poured from buggies, and a pumpcrete machine was used on the longer north approach deck.

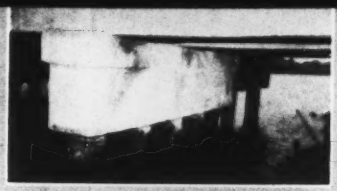
A channel crosses the north approach plaza. This channel is carried under the plaza in a 30 ft × 18 ft box culvert 220 ft long, through which small boats can pass.

The bridge was designed for the Nassau County Bridge Authority (Lt. Gen. C. W. Wickersham, Chairman), by Hardesty & Hanover, consulting engineers, for whom during construction Karl W. Lemcke, M. ASCE, is project engineer and Lloyd Monroe is resident engineer. Prime contractor for the structure is Frederick Snare Corp., with Thomas C. Barnett as project manager. Subcontractors include the Slattery Contracting Co., Inc., for roadways; Phoenix Bridge Co. for superstructure and operating machinery; American Electrical Construction Co., Inc., for electrical equipment, and Gibson Cushman for dredging and hydraulic fill.

Wood and burlap plug was used to hold seal for tremie pour. Weight of concrete pushed out plug when tremie was lifted from floor of cofferdam.

Concrete for tremie seal was delivered by ready-mix trucks which drove out to pouring site on anchored car float. Floating cranes with 1½ cu yd buckets received concrete from trucks and dumped it into tremie pipes.





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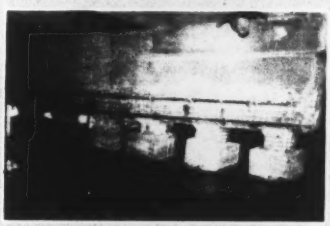

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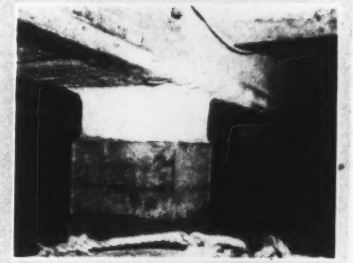

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(1) Pile-supported bent at pier of Baltimore & Ohio Railroad, Curtis Bay, Md., is photographed before start of repair work. (2) Caisson is placed around a pile. (3) Deteriorated concrete is chipped off by workman standing in dewatered caisson. (4) Repaired piles are seen after pouring of concrete in metal forms and placing of mesh for Guniting of area above forms. (5) Repair work and capping are completed.

FIELD HINTS

Concrete piles repaired by caisson method

I. LEON GLASSGOLD, J. M. ASCE

Masonry Resurfacing & Construction Co., Inc., Curtis Bay, Md.

Satisfactory repair of deteriorated concrete piles is developing into a major problem as many bridge and dock facilities reach the 15- or 20-year age mark. Alternate freezing and thawing, chemical action, and probably several little known causes result in necking and disintegration of concrete piles between the high and low tide levels. Above and below these limits the pile section remains unaffected. To repair such piles the Masonry Resurfacing & Construction Co., Inc., of Curtis Bay, Md., has developed the "Dri-Por" system.

Older methods of repair used a diver to clean the pile of marine growths and to remove disintegrated concrete. The efficiency of this type of operation is impaired by the bulkiness of the diver's equipment and his inability to see what he is doing, especially in the polluted waters of modern harbors. As a result the pile is usually not cleaned sufficiently, or cut to the correct depth, to secure a good bond with the new concrete.

After a pile is chipped, mesh is usually placed around it and a form is set. The form is then sealed in some manner and dewatered, after which the pile is poured, or pouring may be by tremie. With these procedures it is virtually impossible economically to eliminate all water from the form. Another drawback is that, if any period of time elapses between the cleaning of the pile and the pouring of the concrete jacket, the rising and lowering of the tides may leave a film of scum, oil or other material on the recently cleaned pile, which will affect the bond. Once the form has been placed it is difficult to detect fouling of the pile.

To eliminate the drawbacks of the older methods and provide positive control at all stages of repair, the Dri-Por system has been developed. It follows the older methods in the various steps involved but differs from them in technique and procedure. With this method the extent of the deterioration can be clearly seen, and after the pile is cleaned, it is protected by the caisson from contamination by oil slick or scum. Gunite is utilized to repair the top of the pile, above the encasement.

The largest job so far done by this method is on the coal export pier of the Baltimore & Ohio Railroad at Curtis Bay, Md. This pier, built in 1916, is of reinforced concrete construction supported by some 1,500 precast concrete piles 15 in. square. The water in this area is contaminated by industrial and chemical wastes and is subject to freezing in winter. Over the years the piles had deteriorated to the point where some sections had disappeared completely. Since this is one of the railroad's major installations, it was desired to secure the best obtainable type of repair. It was required that the piles be repaired in the dry, with the entire area of deterioration clearly visible and accessible.

With this requirement it was believed that the following results could be obtained:

1. Thorough cleaning of old concrete to insure good bond with the new concrete.

2. Cleaning and replacement of reinforcement as required.

3. Protection of durable concrete able to withstand scour and alternate freezing and thawing, and to provide lasting protection for the reinforcement.

Protection against scour was secured in several ways. The original pile section was enlarged several inches for the length of the repair, and the concrete was poured into a metal form which remains in place permanently.

The open-topped caisson is specially designed to allow room for a man to work on the pile, and is sealed against entrance of sea water. After setting, the caisson is pumped dry, and kept so by pumping as required. A workman enters the caisson and chips away the eroded concrete down to a hard base. If it is necessary to cut behind the reinforcing rods or even completely through the pile, this is done. The reinforcement is then appraised and if necessary is repaired or replaced. Next, wire mesh is anchored to the pile.

The pile is now ready for the permanent steel form which is placed around it and fastened to prevent movement in any direction. This form is designed also to prevent appreciable bulging during pouring. It is set independently of the caisson and ends at least 6 in. above the floor of the caisson. Thus any movement of the caisson itself will not disturb the concrete in the form. Also, any leakage in the caisson will not wash out the concrete at the bottom of the form. Chipping of the pile is followed promptly by forming and pouring. Care is taken to avoid displacement of the form during pouring since realignment is difficult.

The final step in this method is the repair of the pile above the encasement with Gunite. This work is usually started after sufficient piles have been encased to make the operation economically feasible and also to provide a better looking job and help protect the pile encasement. This repair consists of chipping the exposed

ENGINEERS' NOTEBOOK

Wheel impact damages rail joints

G. W. HUNT, Civil Engineer, Maintenance-of-Way Inspector, Baltimore & Ohio Railroad, Baltimore, Md.

Few railroad maintenance men realize that the impact of engine wheels at rail joints increases as the third power of the gap between the ends of the rails. Where the rail ends at a joint are at different elevations, the virtual rail gap may be greater than the actual gap. The virtual gap is the horizontal distance between the point where the wheel loses contact with the leaving rail and the point where it makes contact with the receiving rail.

To reduce maintenance expense, rails when laid should be adequately anchored in both directions throughout their middle third to reduce creep. Also, precision grinding of rail surfaces at joints should follow the second tightening of joint bolts after laying. In the following demonstration of why it is so important to reduce the rail gap and to maintain the ends of the rails at joints as near as possible at the same elevation, three conditions are considered, illustrated respectively by Figs. 1, 2, and 3.

Condition 1. Where the rails at a joint are at the same elevation (Fig. 1)

$$I = \frac{HV^2}{gr^2} G$$

in which

I = impact of blow in ft-lb
G = rail gap, in in.
H = weight on wheel
V = speed
r = radius of wheel
g = acceleration of gravity

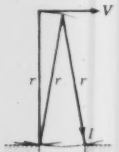


FIG. 1

If H = 20,000 lb, V = 50 mph = 73.3 fps; r = 16.5 in.; and g = 32.2 ft per sec², then

$$I = 742.8G^2 \qquad (1)$$

Condition 2. Where the difference in rail elevation, D, at the joint is such that the virtual rail gap and the apparent rail gap are the same (Fig. 2),

$$G = \sqrt{2RD - D^2}$$
$$= \sqrt{2RD} \text{ (approx.)}$$
$$= 5.74\sqrt{D}$$

FIG. 2

$$I = \frac{2HV^2}{gr^2} G = 1,485.6\,G^2 \qquad (2)$$
$$= \frac{4 \times 2HV^2}{gr^2} D^2 = 281,644D^2$$

Condition 3. Where the difference in rail elevation, D, at the joint is such that the virtual rail gap exceeds the apparent rail gap (Fig. 3),

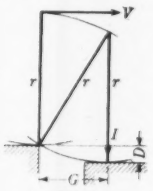


FIG. 3

$$G = 5.74\sqrt{D}$$
$$I = 1,485.6\,G^2 = 281,644D^2 \qquad (3)$$

pile down to firm concrete, placing mesh, and shooting Gunite to the lines of encasement.

At Curtis Bay, working conditions were far from ideal and many problems arose that seemed almost insurmountable. The low overhead caused difficulty because when the tide was high the caisson could not be set or the water would overflow it and drive the men out. Therefore work could only be done at low tide.

The large coal unloading towers are supported by rows of triple piles running the length of the piers. These piles are critical since they carry a major part of the load of the structure and had to be encased. However, in many places where the piles were twisted or inclined, or in close proximity to neighboring piles, a specially designed caisson had to be used to provide enough space for a man to work comfortably.

To facilitate the work, special floating equipment had to be developed, including a well boat which allowed a man to work up to his waist in water. These and similar problems, depending on the location, design, and type of construction and tidal variation determine the difficulty of the work and hence the cost.

The only limitations on this method are those of space. The piles may be too close together to allow the smallest caisson to be fitted in or the piles may be in clusters so that a caisson cannot be maneuvered into position. In general the minimum pile spacing for repair by this method is 3 ft on centers. The method can also be adapted for the restoration of wood piles.

For the contractor, the work at Curtis Bay was under the supervision of the writer and S. S. Glassgold. Engineers in charge for the Baltimore and Ohio Railroad were John T. Andrews, Special Maintenance Engineer, G. H. Davett, M. ASCE, Assistant Bridge Engineer, and H. W. Routenberg, Master Carpenter.

Condition 1 represents the theoretical ideal to be approached by maintaining a proper joint gap and using precision grinding. It is the datum from which the effects of wide gaps and erratic inequalities in rail elevation can be measured. It should be observed that the impact is the same regardless of whether the low rail is the receiving rail or the leaving rail.

The foregoing formulas express the relations between G, D, and I. By assigning the representative values for W, V, and r indicated under Condition 1, the chart, Fig. 4, has been prepared. Differences in rail elevation range up to 0.0303 in., corresponding to a virtual rail gap of 1 in. and an impact of 1,485.6 ft-lb. In Table I, the effects on impact of various differences in rail elevation are shown.

Considering the tolerance of $\frac{1}{64}$ in. under to $\frac{1}{32}$ in. over, permitted by AREA specifications, a 1-in. virtual gap may be considered the maximum ordinarily encountered with new rails.

For purposes of comparison it is of interest to state that the impact of 1,485.6 ft-lb is only one-eighth that caused by a flangeway, a spalled rail end, or a flat spot burned on an engine driver having a D of 0.121 in. and a G of 2.0 in. Even if the initial magnitude of D and G are reduced to a minimum, traffic causes wear at contact points between rails and joint bars, batters rail ends, and increases the magnitude of D in proportion to the impact.

A comparison of Cases 2 to 5 with Case 1 in Table I shows that the impact is not reduced by restricting the apparent gap to the maximum of $\frac{3}{8}$ in. required for contraction and expansion unless the virtual gap is reduced to a like size at the same time. Such reduction of the virtual gap requires precision grinding of rail joints a few weeks after the rails are laid and the joint bolts tightened.

Hardening vs. Grinding of Rail Ends

Hardening of rail ends aims to alleviate the effect of impact but does nothing to correct its cause. Thus, in Case 3 of Table I, the hardened rail end would face a handicap of 8 to 1 as compared with a rail end ground down to fit Case 1. An end-hardened rail cannot overcome this initial handicap under extended service, even under the optimistic assumption that surface batter will be entirely prevented by end hardening. Under extended service, a reduction of this handicap to 4 to 1 is the best that can be expected for the joint assembly as a whole. Rail end grinding is much more practical, far less expensive, and promises four times the advantage that can be expected from end hardening, and it should certainly be preferred to any end hardening in the field.

Rail ends that are spalled, mashed, or severely battered may require welding and grinding. Where such conditions do not exist, welding and grinding cannot do anything that grinding alone cannot do at less expense and with more assurance of success. With the initial precautions of proper anchorage and precision grinding, the necessity for renewing joint bars and building up rail ends could be long deferred if not entirely avoided.

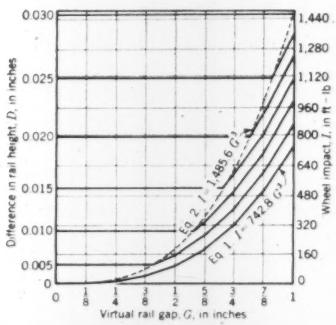


FIG. 4

TABLE I. Effect of Differences in Rail Gap on Impact

Case	Apparent Gap, In.	Difference in Ft, D, In.	Virtual Gap, G, In.	Impact, I, Ft-Lb	Relative Impact	Remarks
1	1/4	0.003	1/4	45.3	1.0	Ideal condition
2	1/4	0.010	1/16	264.8	5.8	
3	1/4	0.012	1/4	362.8	8.0	Mean condition new rail
4	1/4	0.020	15/16	796.8	17.6	
5	1/4	0.030	1	1,485.6	32.8	Max condition new rail
6	1/4	0.003	1/4	368.4	8.1	Min with 1/4 in. gap
7	1/4	0.010	1/4	497.2	11.0	
8	1/4	0.017	1/4	626.8	13.8	
9	1/4	0.020	15/16	796.8	17.6	
10	1/4	0.030	1	1,485.6	32.8	

THE READERS WRITE

Work on Washington, D.C., Water System in 1927 Illustrated

To the Editor: Changes in contractor's plant and equipment and utilization of manpower in engineering work since 1927, are graphically illustrated in the accompanying photograph from my files.

This photograph shows seven men moving a contractor's shelter for testing apparatus near the Reno Reservoir. It was taken during the construction of one of the new water mains for the Washington, D.C., water supply system and was given to me by Otto D. Voigt, the engineer in charge of the project. He is shown in the foreground. Mr. Voigt is now Chief of the Engineering Branch.

—Philip O. Macqueen, M. ASCE
Chief, Eng. Branch, Water Supply Div., Washington District, Corps of Engineers (Retired)

Washington, D.C.

California Chapter Members Win Mead Prize Five Consecutive Years

To the Editor: In the January issue (p. 112) it is noted with great interest that the 1951 Daniel W. Mead Student prize for a paper on ethics was again awarded to a member of the Student Chapter at the University of California. Marion K. Harris joins a rather long list of men from this Chapter who have won the prize: L. G. Lamon in 1947, F. J. Kersnar in 1948, William H. Blair in 1949, and G. L. Laverty in 1950. This represents five awards of this prize claimed by Chapter members out of the eight awards presented since its inception. In addition, Honorable Mention was awarded to A. Collin in 1940.

A great deal of the credit for this fine showing must be given to Prof. Clement J. Wiskocil, former Faculty Adviser to the Chapter, and president of the San Francisco Section of ASCE, and to Prof. B. A. Vallerga, Faculty Adviser.

Professor Wiskocil studied under Dr. Mead at the University of Wisconsin and the association made a deep impression on him. In his present course in Engineering Relations he draws heavily on Dr. Mead's ideas and ideals of ethics, gleaned from personal contact and lifelong study of Dr. Mead's published material on the subject.

In turn Professor Wiskocil has left his mark on hundreds of fortunate students who have studied under him and known him through his interest in their activities and problems.

George W. Bohn, J. M. ASCE
University of California '50

Alexandria, Va.

Outstanding Members Rated for Services to Profession

To the Editor: Utilizing the ASCE Year book for 1947 along with the Index to Transactions, Vols. 100 to 112 (1935–1947), the writer has made a study to identify those members whose services as ASCE officers, whose honorary awards or contributions to Transactions, have made them deserving of special recognition. The following credits were arbitrarily accorded: 10 credits for each year of service as president; 5 for each year as vice president, secretary, or treasurer (or for combinations thereof, such as secretary-treasurer); 3 credits for each year as director; 10 credits for an annual award, including Honorary and Life Memberships; 5 credits for each original paper including author's closure, and a single credit for each discussion, published in Proceedings and Transactions. On this basis first place goes to Francis Collingwood, with 168 credits. Carl Ewald Grunsky follows with 156, and John Cyprian Stevens is third with 151. The first thirty names are listed as follows:

No.	Member	Credits
1	Francis Collingwood	168
2	Carl Ewald Grunsky	156
3	John Cyprian Stevens	151
4	Charles Warren Hunt	150
5	James Laurie	
6	John Alex. Low Waddell	
7	John Ripley Freeman	145
8	John Bogart	143
9	Desmond Fitzgerald	
10	Clemens Herschel	141
11	James B. Francis	140
12	William Jarvis McAlpine	137
13	J. James R. Croes	136
14	Arthur Newell Talbot	129
15	Allen Hazen	121
16	Alfred Wingate Craven	115
17	Theodore Cooper	113
18	Edward Payson North	111
19	Daniel Webster Mead	110
20	William Cain	105
21	Rudolph Hering	
22	George Fillmore Swain	104
23	Don Juan Whittemore	
24	Louis Julian LeConte	100
25	Charles Emery	
26	T. Kennard Thomson	96
27	Thomas Curtis Clarke	95
28	William Barclay Parsons	94
29	Julius Walker Adams	
30	Charles Conrad Schneider	93

(It is to be noted that No. 5, James Laurie, was President for the first 15 years of the Society's existence.)

An extension of this list to include 300 or 500, or even 1,000 leaders, with revisions in the system of credits if deemed advisable, and brought up to date to complete the century of ASCE history, with a suitable breakdown to indicate the origin of respective credits, might be worth while in connection with the Centennial observance as an acknowledgment of the services rendered by ASCE members.

Clarence S. Jarvis, M. ASCE

Salt Lake City, Utah

Practical Improvements in Velz Procedure Welcomed

To the Editor: I have read with much interest the article on "More Accurate Population Estimates by Means of Logistic Curves," by John E. McLean in the February issue, p. 35.

It is difficult to imagine an art more important to the engineer than the estimation of trends and their extrapolation into the future. The art of guessing what will happen to the numbers of people in selected communities—large and small—is at once the most important and least understood of all. It is a commentary on our professional isolation from other founts of wisdom, that neither medical science nor social science, nor any other modern expanding science, has helped very greatly to answer the engineer's basic query—"How many?" However complex or impossible the task may seem, the engineer must face it before he can design many structures for full capacity during their useful life. Almost to the present day, the engineer's approach is typified by the advice found in Mansfield Merriman's *Civil Engineers' Pocket Book* (1916 edition, p. 971):

> Future Population Growth.—[the] ultimate population may be estimated by experience with other cities in a similar country with similar population.

A truly forward step was made when Professor Velz looked over Professor Pearl's shoulder and reported what Pearl had discovered by looking over Verhulst's shoulder. Every engineering follower of these revelations will be doing his profession a service in clarifying and systematizing the very practical Velz device for estimating growth. Mr. McLean can congratulate himself in the certainty that he is one of these.

We need not seem to be carping, obstructive critics of a good suggestion if we point out one or two pitfalls in our engineering approaches to population estimating. For example, whether a newly developed engineers' transit is "more accurate" than the tumbledown veteran left in the rack, depends very greatly on the chap squinting through the eyepiece. And even if he is an accurate chap, his "more accurate" transit can be less accurate if its adjustable parts are less easily controlled than those of the more simply constructed veteran transit.

The hypothetical *S* curve, shown dotted in Mr. McLean's Fig. 3 (February, p. 37) has several pertinent characteristics, each more or less independent of the other: (1) The upper and lower asymptotes can be spread to an infinite number of positions; (2) the curve can be rotated 180 deg about its middle (point of contraflexure), beginning with a vertical asymptote; and (3) the mid point can be translated to an infinite number of positions. The results of doing these various things with the *S* curve are shown in Fig. 2, and Mr. McLean has offered a suggestion for selecting the "more accurate" asymptote (saturation), mid point (half saturation), and slope (growth coefficient).

Seldom will an engineer be called upon to provide facilities for a population more than 30 years hence, the unused part to be paid for and maintained by a smaller population for some estimated future benefit to posterity. For many practical engineering purposes, thirty years is a long time to amortize a debt. For this reason, the saturation point (an infinite distance in the future) appears to be the least important of the three characteristics. Its importance is like that of a design constant, or circumpolar star. For purposes of comparison, Mr. McLean has plotted Dixon, Ill., at several assumed saturation values from "no growth" (k = 11,000) to more than double the 1950 census (k = 26,400). In thirty years, these arbitrary values of k would promise a growth of from zero to 4,000 additional people. An experienced estimator could reduce the spread to 2,500, graphically or "by eye." The extent to which such an "error" may be important to the officials around the conference table will be a measure of the money expendable to find a "more accurate" design value by elegant mathematical refinement.

The analysis proposed is emphatically to be commended to the planners of nations, regions, states, counties, metropolitan areas and the larger cities. Carefully computed tables of saturation values for such large areas, tested and reexamined after every major census, should be part of the standard handbook data on the desk of every planner. From these logical and searching large scale analyses, it is possible to analyze small groups in comparison with the larger areas of which they are a part by tracing the relative long term distribution of population between the parts (see "Long Term School and Community Growth Estimates," by the writer. Mimeographed manuscript distributed privately. Copyright 1950). Mr. McLean's excellent proposal tends to become impractical for very small communities, but even there it deserves an important place in the engineer's check list of things to do with a problem when he faces the impossible.

Harold T. Larsen, M. ASCE
Editor, Technical Publications, ASCE
New York, N.Y.

Social Values Seen as Important to Economic Status

To the Editor: May I say a word paralleling J. L. Harrison's letter in the December issue relative to written examination of engineers as a method for job selection? Like Mr. Harrison, I agree that for a P-1 grade, a written examination of a young man just out of college may be useful. It's the only experience he's had and therefore a written examination is justifiable. When it comes to appointment to higher grades, many factors are more important than book learning.

I think of the engineer at his job as one of many people of various vocations constituting a community or society of people exchanging labor, that is, transacting business. This society is not classless; neither are the individuals equal in standing. As a simple illustration, let us consider a community where living standards are only at a subsistence level. In such a community people make social distinctions. Any society of people involuntarily establishes social distinctions and prejudices regarding individuals. Social distinctions are evaluations of the quality of men and not evaluations of their property.

The people who make up the engineer's community must necessarily rub elbows or associate with one another in some measure. The engineer's community is not only where he works, locally and nationally, or where he lives locally and nationally; it is also his technical society or association, his club, his business contacts. Unavoidably and involuntarily this community develops social distinctions or a social structure whether or not it develops a business structure, and its social concepts take precedence over business concepts.

These distinctions are caused by the individual's personality, integrity, knowledge, ability to make friends (and thus influence others), and judgment. They are based on social relationships.

The successful engineer is the one to be preferred for appointment over those not so successful, if possible. He is successful because his economic value is greater than that of others. Yet it is a maxim that the quality of a man's social relationships determines, to a major degree, his economic value. That being true, evaluations of these social relationships along with the personal values are required, and so far, as Mr. Harrison has pointed out, there has been no generally accepted method of measuring them. Certain it is that purely technical examinations will not suffice for selecting men for higher administrative and executive engineering posts.

Victor J. Brown, A.M. ASCE
Editor, Gillette Publishing Co.
Chicago, Ill.

SOCIETY NEWS

Outstanding Program Scheduled for Denver Convention in June

Denver is famous for its beautiful Civic Center featuring state and municipal buildings in an impressive setting. Immediately adjacent is city's principal shopping district.

This view of Colorado-Big Thompson Project, objective of one of inspection trips being arranged for visitors to Denver Convention, shows Olympus Dam and Estes Lake in background.

Plans for the ASCE Denver Convention—to be held in the mile-high city in the Colorado Rockies, June 16–20—are rapidly being advanced by committees of Colorado Section members, who are doing their utmost to assure Convention visitors an exceptional program of technical sessions, field trips and entertainment. Observing the ASCE Centennial, the meeting will emphasize the theme of one hundred years of engineering progress—a theme of special significance in a young state whose development has been entirely within the past century of engineering progress. The Convention committee is headed by Alfréd J. Ryan, general chairman; Robert F. Blanks, vice-chairman; and Kenneth R. White, secretary.

Headquarters for the various events of the Convention week will be the Cosmopolitan Hotel in Denver. The ASCE Technical Divisions will have their sessions there, beginning Tuesday and extending through Friday. Seventeen of these sessions, devoted largely to current civil engineering developments, will be one of the Convention highlights. W. E. Blomgren is technical session chairman. The full technical program will be published in the May issue.

No effort is being spared to make the Convention a never-to-be-forgotten vacation time for the visitor as well as worth while from an engineering standpoint. In addition to the traditional luncheons, banquets, smoker, and entertainment for the ladies, full advantage will be taken of the mountain playgrounds west of Denver for entertainment of Convention guests. A chuck wagon banquet, Western style, is planned at Red Rocks Park, a part of the city's 51-square mile area of mountain recreational reserves.

Several mountain trips will be available. Of special interest to engineers will be a short trip over the newly opened Denver-Boulder Turnpike. At Boulder there will be an opportunity to view the University of Colorado campus, rugged Boulder Canyon, the Continental Divide, and early-day gold mining scenes. The return trip to Denver will be over the new link on Highway U.S. 40 through scenic and historic Clear Creek Canyon.

A spectacular tour to the newly constructed Colorado-Big Thompson transmountain diversion project will climax the Convention week. The project, including the dams forming Green Mountain Reservoir, Granby Reservoir and

Shadow Mountain Lake, together with the power and pumping plants, the 13-mile Adams Tunnel, and the extensive conveyance and storage systems on the eastern slope of the Rockies, will provide a striking example of the reclamation planning and construction which have contributed so greatly to the development of the West. In addition to the engineering features of the trip, the tour will traverse a mountain area of exceptional beauty.

The recreation and vacation possibilities available to the engineer and his family as well as the exceptional technical program should suggest a combined Convention and vacation trek to Denver in June.

Structural Division to Try Something New

ERNEST C. HARTMANN, M. ASCE, Chairman of Committee on Promotion of Member Participation in Technical Activities, Structural Division, ASCE

The technical committee work of the Structural Division of ASCE is an accomplishment of which members can be proud. The Executive Committee might well sit back and bask in the glow of a job well done. However, true to the motto of the civil engineer, the Committee having accomplished the difficult, will now essay the impossible in the earnest hope that it may not take as long. In short, the Division proposes to encourage even wider participation of the members. For this purpose a new Committee on Promotion of Member Participation in Technical Activities has been appointed.

This new venture can best be described by a statement of J. M. Garrelts, chairman of the Structural Division: "It is my personal belief that the future welfare of technical activities of ASCE depends on making it possible for every member of the Society to take part in these technical activities." With professional societies as with any other organization, the benefits realized by the membership are in proportion to its contributions to the work of the society."

An invitation to take part in the technical activities of the Structural Division is here and now extended. The Division assumes that of the several thousand members who have designated structural engineering as their principal field of interest there are many who would like to take part in the technical activities if they knew how. This article is an attempt to describe how members can participate. We hope for additional suggestions and support from the members. At the present time we offer the following suggestions:

1. Take part in the present active committees as a committee member.

2. Write technical articles for publication.

3. Send in information on present committee work to committee chairmen. (You don't have to belong to a committee to assist in its work.)

4. Help start new committees on subjects in which you are interested. This can be done by a group of members who might together present a proposal for a new committee to the Division chairman. The Division Executive Committee will authorize such new committees as seem to be needed and will provide support.

5. Assist the Division in reviewing and editing papers for publication.

In conjunction with the foregoing suggestions the Division will describe briefly in two future articles the past and current work of the existing technical committees which include the following:

1. Committee on Design of Light-weight Structural Alloys. Chairman, C. N. Gaylord.

2. Committee on Factors of Safety, Working Stresses, and Load Factors. Chairman, O. G. Julian.

3. Committee on Semi-Rigid to Column Connections. Chairman, W. H. Weiskopf.

4. Committee on Deflection Limitations of Bridges. Chairman G. S. Vincent.

5. Committee on Measurement of Dead Load Stresses in Mississippi River Bridge. Chairman, W. H. Jamesons.

6. Committee on Timber Structures. Chairman, H. J. Hansen.

7. Committee on Bridge Loadings. Chairman, T. Y. Lin.

8. Committee on Seismological Forces. Chairman, R. W. Binder.

9. Committee on Wind Forces. Chairman, C. H. Gronquist.

10. Committee on Masonry and Reinforced Concrete. Chairman, R. F. Blanks.

11. Committee to Study Plate Girders. Chairman, Neil Van Eenam.

The primary purpose of the proposed articles will be to provide information to members interested in participating. It is hard to imagine a structural engineer who has not encountered some of the problems being investigated by the committees listed and the wide scope of the committee work should challenge the attention of a large number of members of varying interests. All who are interested in participating more actively in the technical work of the Structural Division are urged to address the writer at P.O. Box 772, New Kensington, Pa.

Manual of Professional Practice Issued by ASCE

Availability of the long awaited *Manual of Professional Practice for Civil Engineers*, compiled by the ASCE Committee on Private Engineering Practice, is announced by the Society. Issued as No. 29 in the Manual of Engineering Practice series, the present publication supersedes Manuals 5 and 6, which are out of stock. Members of the Committee on Private Engineering Practice are N. T. Veatch, chairman, John H. Morrison, Herbert C. Gee, Gustav J. Requardt, and Edmund Friedman.

Aspects of professional practice covered in Manual 29 include Public Service and Governmental Employment; Contracts for Service; Classification of Engineering Services; Bases for Making Charges; Overhead; Re-Use of Plans; and Estimating Fees for Professional Engineering Services.

For convenience in purchasing, an order blank has been provided in the advertising section of this issue. Copies are priced at $1 each, with a 50 percent discount available to ASCE members.

UPADI Meeting to Be Held in New Orleans

Progress being made in plans for a meeting of UPADI (Union Panamericana de Asociaciones de Ingenieros), to be held in New Orleans, La., August 26-30, was reported at the January 25 meeting of Engineers Joint Council by S. E. Reimel, secretary of the EJC Committee on International Affairs. It was voted to establish a local group of United States engineers to aid working out final plans.

The UPADI special committee will consist of J. M. Todd, chairman; E. A. Pratt, vice chairman; and S. E. Reimel, secretary.

ASCE Technical Sessions Set for Centennial of Engineering

Howard Peckworth

As chairman of the Society's Technical Program Committee, G. Donald Kennedy has assembled the preliminary programs of the thirteen Technical Divisions for the ASCE part of the Centennial celebration in Chicago, September 3-13, 1952 (January issue, page 109) and dates have been established in accordance with the following schedule. To further advance plans, Chairman Howard E. Peckworth, of the ASCE Committee on Arrangements, has assigned meeting rooms for all Technical Division sessions.

The Construction Division will meet all day Wednesday, September 3, in joint sessions with the Associated General Contractors of America, with a joint ASCE-AGC luncheon at noon. On Thursday, September 4, the Division will meet again in the morning, and is arranging a joint session with the Structural Division in the afternoon. On Friday, September 5, the Division expects to have a joint session with the Irrigation Division in the morning, and a joint meeting with the Highway Division in the afternoon.

Two sessions have been scheduled by the Air Transport Division for Friday, September 5, and there will also be an all-day meeting of the Highway Division on that date. Saturday and Sunday, September 6 and 7, are open for viewing exhibits and general sightseeing.

The Engineering Mechanics Division will have all-day meetings both Monday and Tuesday, September 8 and 9. The Soil Mechanics and Foundations Division is also arranging morning and afternoon sessions, both days. There will be two sessions of the Sanitary Engineering Division on Monday, and one on Tuesday morning.

In addition to its joint session with the Construction Division, the Structural Division has plans for several other meetings, beginning with a joint session with the Engineering Mechanics Division on Monday afternoon, September 8, followed by a joint session with the American Welding Society on Tuesday morning, the ninth. It will also have an independent session Tuesday afternoon. An all-day program of meetings is being arranged for Tuesday by the Power Division, and the Hydraulics Division plans a Tuesday afternoon session.

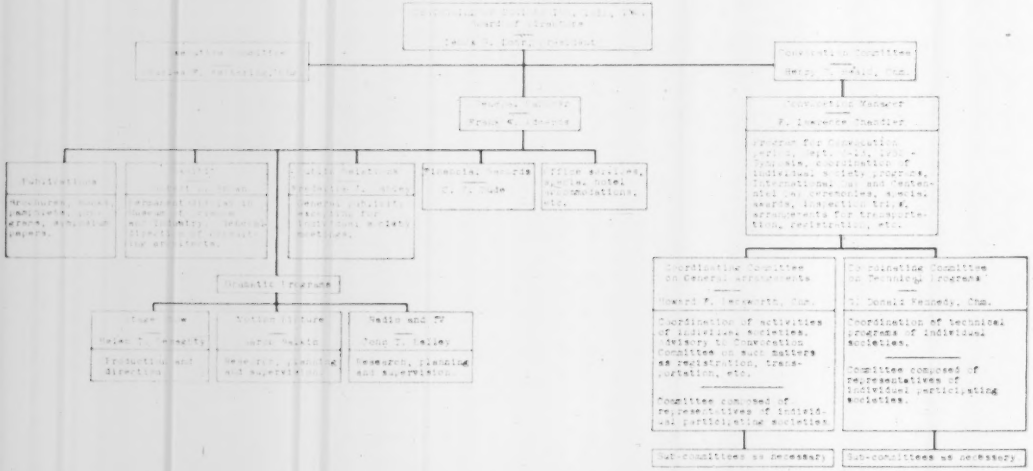
No technical sessions of any of the participating societies are scheduled for Wednesday, September 10, which has been designated as Centennial Day and will be the occasion for special events. Highlights will include a general luncheon meeting for all engineers in attendance at the Convocation, followed by an address by a prominent engineer and conferring of engineering awards. The Centennial Banquet in the evening, to be attended by some 5,000 engineers, will feature an address by another nationally known engineer.

On Thursday, September 11, the City Planning Division will have two sessions. The Irrigation Division plans two sessions on Thursday, and two on Friday, September 12. The Waterways Division is also arranging for all-day meetings on Thursday and Friday, and the Surveying and Mapping Division will meet all day Friday. Supplementing its other meetings, the ASCE Structural Division will have all-day joint sessions with the American Concrete Institute on both Thursday and Friday, seven sessions in all.

In addition to the technical sessions of the individual societies, general symposium sessions (twelve in all) will be held daily. The symposium program was outlined in the February issue, page 55.

As indicated on the organization diagram of the Centennial of Engineering reproduced on this page, Mr. Kennedy also heads up a committee of 40 or more representatives, one from each participating society, to coordinate the numerous technical programs of individual societies. In addition to his chairmanship of the ASCE Committee on Arrangements, Mr. Peckworth also heads a coordinating Committee on General Arrangements to advise on registration procedures, inspection trips, and ladies' entertainment for all the participating societies.

It is not too early to be making plans to be in Chicago, September 3-13, during the Centennial of Engineering, and to have a part in what is expected to be the largest and most significant gathering of engineers ever assembled.


Coordination Committee on General Arrangements
Howard E. Peckworth, Chm.
Coordination Committee on Technical Programs
G. Donald Kennedy, Chm.
Coordination of activities of individual societies. Advisory to Coordination Committee on such matters as registration, transportation, etc.
Committee composed of representatives of individual participating societies.
Coordination of technical programs of individual societies.
Committee composed of representatives of individual participating societies.
Sub-committees as necessary
Sub-committees as necessary

Junior Members May Have Lapel Button

For the first time Junior Members of ASCE may have a small Society lapel button, somewhat similar in appearance to the emblem previously authorized for lapel wear by Members and Associate Members. The new lapel button, shown here in actual size, is a small blue shield surrounded with a white band and lettered in gold. It has a buttonhole type of fastener.

The selling price of $1.50 includes the 25 cent federal excise jewelry tax. The tax is not payable on export orders. Orders should be forwarded to the Executive Secretary, ASCE, 33 West 39th Street, New York 18, N.Y.

Student Chapter Member Awarded Scholarship

For his outstanding scholarship and activity in the ASCE Student Chapter at the University of Minnesota, William B. Hamre has been awarded a $200 scholarship by the Northwestern Section of the Society.

Organization of New Alaska Section Completed

Following Board authorization of an Alaska Section at its meeting in New York in October, members of ASCE living in Alaska have been busy completing organizational details. To maintain an active organization in the vast 586,400-sq mile area comprising the territory, Section operation will center in three Sub-Sections located in Juneau, Fairbanks, and Anchorage. Headquarters of the Section, determined by the number of Society members signing the petition for formation of the Section, will be Anchorage.

There will be a minimum of nine Sub-Section meetings a year, with an annual convention-type meeting of the entire Section to be held each September in the Sub-Section where the Section president resides. Section officers are Clarence Moriarty, Anchorage, president; A. F. Ghiglione, Juneau, first vice-president; H. W. Johansen, Fairbanks, second vice-president; W. H. Butler, Anchorage, secretary and J. A. Westbrook, Anchorage, treasurer.

Juneau Sub-Section officers are William K. Boyd, president; Amos J. Alter, vice-president; and L. D. Rainery, secretary-treasurer. Officers of the Anchorage Sub-Section are Harold L. Moats, president; John C. Hooper, vice-president; and John L. Cerruti, secretary-treasurer.

Formation of the new Section brings the total of ASCE Sections to 73.

Proceedings of Prestressed Concrete Conference Issued

Publication of the Proceedings of the first U. S. Conference on Prestressed Concrete held at Massachusetts Institute of Technology, August 14-16, 1951 is announced by the Institute. Sponsoring groups were the Structural Division of ASCE, the American Concrete Institute, the American Institute of Architects, the American Railway Engineering Association, the Associated General Contractors of America, the Portland Cement Association, and the M.I.T. Department of Architecture, Department of Building Engineering and Construction, and Department of Civil and Sanitary Engineering.

The Proceedings cover seven conference sessions divided into the general topics of application, materials, design and research. Copies may be obtained from the Prestressed Concrete Conference, Room 1-163, Massachusetts Institute of Technology, Cambridge 39, Mass. The price is $1.50 plus 12 cents postage anywhere in the United States, and 21 cents to Canada and other foreign countries. Checks should be made payable to M.I.T. Account No. 1796-63A.

Symbol for Centennial of Engineering Approved

The accompanying figure shows the approved symbol for use in all phases of publicity with respect to the Centennial of Engineering celebration. Official approval came from the Chicago office of the corporation, Centennial of Engineering, 1952, Inc., on February 20. Numerous ideas were considered for the symbol before the corporation arrived at the design shown. Among the basic criteria were simplicity and ease of recognition. The adopted design meets both.

It is expected that the Corporation will make available cuts to all societies participating in the Centennial celebration with the hope that it will be freely used as a means of drawing attention to the Centennial. It may be used appropriately on letterheads, as part of headings for articles in Society publications, in advertisements of business organizations, and in other ways.

Texas Section Plans Its Spring Meeting

Arrangements for spring meeting of Texas Section, to be held in Beaumont, Tex., April 17, 18, and 19, are being made by Southeast Branch of Section, which was recently organized by Section to handle affairs connected with meeting. Photograph shows (left to right, front row) Ben H. Anderson, J. E. Jenkins, G. F. Davenport, C. P. Smith, C. J. Traube, H. A. Barr, C. L. Davidson, C. W. Pressley, and W. C. Schoeller. In back row, same order, are G. P. Smith, A. W. Brown, O. B. Hartzog, W. P. Stine, H. C. Kershner, Jr., A. J. Stocker, and George Schaumburg.

FROM THE NATION'S CAPITAL

JOSEPH H. EHLERS, M. ASCE — Field Representative ASCE

NPA Regulations

Engineers and the construction industry will soon be confronted with the most comprehensive of all the NPA control orders, a veritable regulation to end all regulations. It is expected to be released during March with only minor changes from a draft submitted to the NPA Advisory Committee for suggestions. Basically the prospective order is a compilation of the existing regulations, combining CMP Reg. 6 and NPA order M-4A. It will replace practically all existing orders on construction controls.

It will exclude housing, which will be dealt with in a separate order. In view of the vastly different approach to controls on housing, this will constitute a simplification. Liberalization will occur in the use of foreign steel. An allowance through self certification of up to 25 tons of carbon steel per project for highways and possibly some amount through self certification for schools will be made. Structural shapes will be limited in these self certification allowances.

It is gratifying to report that the NPA Construction Advisory Committee is actively being asked for advice in the preparation of this order.

The industrial expansion program passed its peak early this year. There has been some easing up of steel allotments so that nearly all non-industrial projects started before last October have received allotments for the second quarter. A reactive pool of critical materials is being established for special allotment for important civic structures.

The Construction Industry Advisory Council on which ASCE is represented met in February. It recommended to Mobilization Director Wilson and DPA Administrator Henshaw, both of whom attended the meeting, that a centralized authority for construction be established in DPA. It also urged that conditional authorizations of critical materials be made for future work so that the necessary designing may be undertaken at once.

Critical Materials

Some new trends appear to be developing with respect to the critical metals.

With the slackening of the industrial program, steel will be more readily obtainable this year, even before the output from the new steel facilities becomes available. Structural fabricators already report a marked falling off of inquiries and orders. The steel picture has been clouded by vague statistics and statements regarding shortages. At first it was insisted that all steel was in short supply. When that statement was challenged it was admitted that the shortage was principally in structural shapes. Now it is conceded that the shortage is largely in wide flange shapes. Quite possibly there is a shortage only of specific items. If details were stated in terms useful to designing engineers, they could avoid the use of the scarce items. Large plates, especially for pipelines, and wide flange beams will remain scarce in 1952. There is need for decontrolling items not in short supply.

Aluminum production for 1951 of 1,750,000,000 lb marked the second highest year for this industry. The increase over 1950 took place in spite of a curtailment of power and shortage of scrap. An ultimate capacity of 3,000,000,000 lb is the national goal. Adequate supplies of aluminum should be available by the fourth quarter of this year.

Construction Volume

It is difficult to understand the reasons for controls and the critical materials situation without consideration of the construction volume and the prospective market.

The total dollar volume for 1951 was the greatest this country has ever known, totaling $80 billion. Even private construction, because of an 85 percent increase in industrial projects, equalled the 1950 volume despite declines in residential, commercial and recreational construction.

Even with a possible decline of 10 percent from the $80 billion peak, 1952 would still be a near record year. Individual segments of the construction industry and many particular localities may be very adversely affected however. More than usual fluidity and adaptability will be required. Housing might decline another 25 percent; luxury housing will be much curtailed; recreational construction will be at low level; commercial building may be down another 25 percent below 1950. Even with the declines indicated, the demand for structural steel will probably increase, since military construction, with a possible $1½ billion increase, atomic energy projects, with a possible $1 billion increase, and industrial plants take much more steel per dollar of construction cost than do the declining residential and commercial categories.

Contract Renegotiation

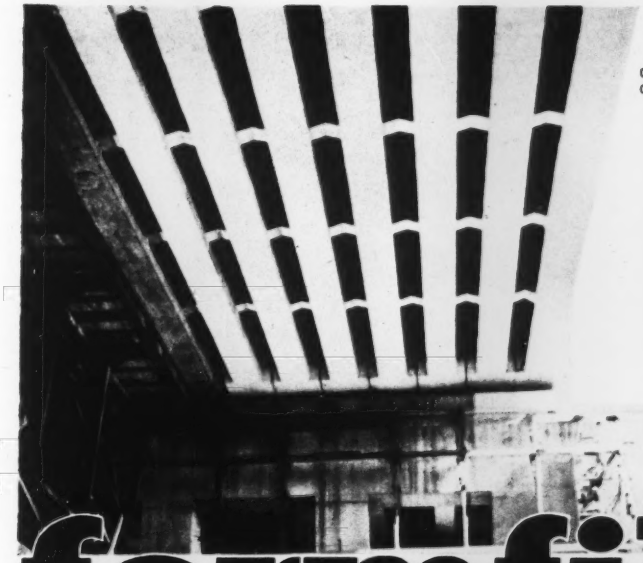
Despite varying reports on the extent of renegotiation of defense contracts, authorities informally state that when receipts from contracts with the specified government departments amount to over $250,000 in any fiscal year, excessive profits may be recovered by the government up to the point where receipts would be reduced to $250,000. Receipts under all contracts with the agencies designated by or in accordance with the Renegotiation Act of 1951 are included, unless a specific exemption is granted. For instance, suppose an engineer had, after entirely excluding receipts from exempted agencies, received $275,000, on which an excessive profit of $25,000 was determined. The government could recover $25,000. If the engineer's total receipts were $260,000 with the same profit, only $10,000 could be recovered. Regardless of whether a contract had any actual connection with defense, receipts under it would nevertheless be included if they were from an agency or department specified under the Act. The Board, for example, has thus far given no indication of heeding requests that a civil works river job for the Corps of Engineers be excluded by regulation. Such a contract is with one of the departments designated hence it is subject to renegotiation, unless individually exempted.

A state or political subdivision contracting with any department is exempt from renegotiation. There are a few other general classes of contracts that are likewise exempt. A tentative draft of proposed regulations appears in the January 10, 1952, Federal Register. Final regulations are expected to be issued soon.

Washington, D.C.
February 20, 1952

ASCE MEMBERSHIP AS OF FEBRUARY 11, 1952

Members	8,916
Associate Members	10,208
Junior Members	15,878
Affiliates	66
Honorary Members	37
Fellows	1
Total	34,206
(February 2, 1951	31,715)



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Heavy scratches for instance, can be quickly recoated when Formfilm is used at the job.
Formfilm is now being widely used in "tilt-up" construction.

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Coming Local Section Events

Central Ohio Dinner meeting at the Ohio Union, Ohio State University campus, Columbus, on March 20, at 6:30 p.m.

Cleveland Dinner meeting at the Cleveland Engineering Society, on March 21, at 6:30 p.m.

Dayton The Section will be host to the District 9 Convention, April 4 and 5.

District of Columbia Meeting at the Cosmos Club Auditorium on March 11, at 8 p.m.

Los Angeles General meeting at Alexandria Hotel, on March 12, at 6:30 p.m. Junior Forum meeting at Alexandria Hotel, on March 12, at 5:45 p.m. Sanitary Group meeting at Hotel Clark, on March 26, at 6:30 p.m. Soil Mechanics Group meeting at the Hotel Clark on March 19, at 6:30 p.m.

Maryland Dinner meeting at the Engineers Club of Baltimore, on March 12, at 6 p.m.

Metropolitan Meeting in the Engineering Societies Building, March 19, at 8 p.m. Junior Branch will hold meetings on March 12 and 26 in the ASCE Board Room, New York City.

Northwestern Dinner meeting in the Junior Ballroom, Coffman Memorial Union, University of Minnesota, on April 7.

Philadelphia Meeting at the Engineers' Club, Philadelphia, on March 11, at 7:30 p.m. Central Pennsylvania Sub-Section meeting at the Harrisburg Civic Club, Harrisburg, to be addressed by President Carlton S. Proctor, on March 17, at 8 p.m.

Pittsburgh Meeting at the William Penn Hotel, on March 11.

Providence Meeting at the Providence Engineering Society, on March 13.

Sacramento Weekly luncheons every Tuesday at the Elks Temple, Sacramento, at 12 noon.

Tennessee Valley Knoxville Sub-Section luncheon meeting at S & W Cafeteria, on March 13, at 12 noon, to be addressed by President Carlton S. Proctor.

Scheduled ASCE Conventions

DENVER CONVENTION
Cosmopolitan Hotel
Denver, Colo., June 16-20, 1952

CENTENNIAL CONVOCATION
Conrad Hilton Hotel
Chicago, Ill., September 3-13, 1952

SAN FRANCISCO CONVENTION
San Francisco, Calif., March 2-7, 1953

Kentucky Commissioner of Highways, William P. Curlin, is principal speaker at luncheon meeting of Kentucky Section. Shown here are John H. Clark, III, secretary of Section; Section President Charles W. Lovell; Mr. Curlin; and Lowell E. Gregg, vice-president.

News of Local Sections Briefed

SECTION	DATE	ATTENDANCE	PROGRAM
Central Ohio	January 17	43	Meeting addressed by Prof. Robert S. Green, chairman, Department of Welding Engineering, Ohio State University. Life membership certificate presented to C. C. Chambers.
Cleveland	January 11	117	D. V. Terrell, dean, College of Engineering, University of Kentucky and Vice-President from Zone III, presented a talk on "A Century of Engineering Progress." Life memberships awarded to Emmet C. Blosser and William H. Hoffman.
Intermountain	January 10	52	Roy W. McLeese, city engineer of Salt Lake City, spoke on the water supply, sanitary sewer and storm sewer systems of that city.
	February 7	46	Lecture on television and recent technical developments given by C. Richard Evans, vice-president and general manager of Radio Service Corp. of Utah.
Ithaca	February 7	21	Dinner meeting. Discussion on the growth of photogrammetry by Talbert Abrams, president of the Abrams Aerial Survey Corp., Lansing, Mich.
Kansas City	January 15	112	Dinner meeting. Speaker: Kenneth K. Kerwin, Centriline Co., New York, N.Y., supplemented his talk on lining old water main pipes with motion pictures.
	February 5	109	Dinner meeting and social hour. Dr. M. H. Thornton outlined the various phases of the Midwest Research Institute.
Louisiana	January 26		Annual dinner meeting. Newly elected officers include: Frank W. Macdonald, president; Sargent F. Jones, first vice-president; Louis M. Buja, second vice-president; C. Glennon Melville, secretary-treasurer; and Robert H. Grehan, junior assistant to secretary.
Maine	January 26		Annual meeting. Officers for 1952 are: Neal D. McDowell, president; Hamilton Gray, vice-president; Vaughan M. Daggett, secretary; and George K. Wadlin, treasurer.
	February 16	36	Discussion by Chauncey S. Robinson, assistant chief engineer, Boston & Maine Railroad, Maine Central Railroad, and Portland Terminal Co., of Boston, Mass.; Edwin S. Metcalf, engineer, W. H. Hinman, Inc., Portland, Me.; and Vaughan M. Daggett, assistant chief engineer, Maine State Highway Commission, on the Fore River Bridge Project. Following dinner, Howard J. Williams, of Fay Spofford & Thorndike, Boston, gave an illustrated talk on the same project.
Maryland	January 9	125	Dinner meeting, with a talk by Dr. George F. Carter of the Isiah Bowman School of Geography, The Johns Hopkins University, entitled "Why Columbus Did Not Discover America."
Metropolitan	January 16	250	James G. Tripp, president of the Tripp Construction Co., New York, N.Y., belatedly received the Society's Construction Engineering Prize awarded to

Construction view of 10-story, 500-bed Veterans Administration Hospital, Iowa City, Iowa. Ellerbe & Co., St. Paul and Leo A. Daly Co., Omaha, architects and engineers. Gust K. Newberg Construction Co., Chicago, general contractor.

More hospitals—quicker and more economically with CONCRETE FRAMES AND FLOORS

THE HOSPITALS America needs can be built quicker and more economically with reinforced concrete frames and floors. Such construction saves time and requires less of those materials that are now in short supply.

In reinforced concrete construction the frame and floor work proceed simultaneously. Thus masons, plumbers, electricians and other tradesmen can do their jobs while the structural work progresses instead of waiting till it is finished. This effects substantial savings in time.

Reinforced concrete construction requires a minimum of steel. Flat plate or slab band design eliminates or reduces the head room required for beams and girders in other types of construction. This permits a reduction in total building height, which, in turn, saves additional amounts of pipe, wire, conduits, ducts and other materials.

Reinforced concrete frame and floor buildings are sturdy, durable, firesafe and economical. Cost analyses and competitive bids throughout the country show that reinforced concrete frames and floors achieve savings up to 40%. They are moderate in first cost, require little or no maintenance and give long years of service. That means ***low annual cost,*** which pleases architects, engineers, owners, investors and taxpayers alike.

For help in designing and building reinforced concrete frames and floors write for free literature, distributed only in the U. S. and Canada.

PORTLAND CEMENT ASSOCIATION

DEPT. 3-13, 33 WEST GRAND AVENUE, CHICAGO 10, ILLINOIS

A national organization to improve and extend the uses of portland cement and concrete . . . through scientific research and engineering field work

			him at the October Annual Meeting. A description of the new U S. Steel Co. plant at Morrisville, Pa., was presented by Harry S. Spitz, assistant chief engineer, Construction Engineering Bureau of U S Steel Co.
Miami	January 1	78	Life membership certificate awarded to Leroy S. Edwards. A Belgium film by Prof. Gustave Magnel was shown by Theodore R. Crom, consulting engineer, Gainesville, Fla., on behalf of Preload Enterprises, Inc., New York. A second film on the Walnut Lane Bridge, Philadelphia, Pa., was presented by D. L. Chaney, regional structural engineer, Portland Cement Association.
Mid-South Jackson	January 10	15	Newly elected officers are Henry C. McGee, president, Irene E. Miller, vice president, and Margaret S. Petersen, secretary treasurer.
Memphis	January 18		Officers for 1952 are Lawton T. Sumner, president; St. George T. Richardson, vice president; and Jacob McBride, Jr., secretary treasurer.
Vicksburg	January 11		Film about the model study for the design of a breakwater for Port Washington, Wis., was shown. New officers are Fred R. Brown, president; Ernest H. Fickler, vice president; and Ralph R. W. Beene, secretary treasurer.
Little Rock	February 2	19	Luncheon meeting. Neal B. Garver led discussion of waterway opening for bridges.
Oklahoma Oklahoma City	February 6	30	Jim Willis, vice president, Oklahoma Advertisers Club, gave an illustrated talk entitled, "Magic Word."
Philadelphia Delaware Sub-Section	January 22	225	Joint meeting with Delaware Society of Professional Engineers and Delaware Alumni of Tau Beta Pi addressed by President Carlton S. Proctor. Life membership certificates to Sanford W. Sawin and Wilbur S. Corkran.
Pittsburgh	February 7	35	Junior program. L. R. Bowman, consulting engineer, Pittsburgh, Pa., lectured on registration of engineers.
Providence	January 15	33	Life membership certificate awarded to James Lee Murray. Speaker Arthur L. Quirk, professor of physics and Director of the Upper Air Research Laboratory, University of Rhode Island, described his experiences in exploring the upper atmosphere with rockets.
Sacramento	January 8		Annual business meeting. Election of 1952 officers. 30th annual meeting and installation of officers including R. Robinson Rowe, president; Walter S. Hulz, first vice president; J. Carl Jennings, second vice president; and Ralph W. Hutchinson, secretary treasurer.
Redding Sub-Section			Officers of the newly created Sub-Section are H. Kenneth Elder, president; Clair A. Hill, vice president; Robert L. Felton, secretary; and Lou Meikle, treasurer.
South Carolina	January 25	35	Annual winter meeting. Newly elected officers are Langdon Chevers, president; L. Y. Dawson, vice president; and Albert F. Johnson, secretary treasurer.
Tri-City	January 29	35	B. H. DeMuth, representative of the Corps of Engineers, described the general features of Veterans Administration hospitals.

Sacramento Section Elects Robinson Rowe President

R. Robinson Rowe, supervising bridge engineer for the California State Division of Highways, heads the roster of Sacramento Section officers recently elected for 1952. Better known to readers of CIVIL ENGINEERING as N. G. Neare, Mr. Rowe is contributing editor of the puzzle department that has intrigued more mathematically minded engineers for exactly twelve years this issue. In addition to these services to the Society, he has the distinction also of having been president of the San Diego Section in 1933 while he was living in that city.

R. Robinson Rowe

Pittsburgh Student Chapter Group Endorses Centennial

Recent action of the University of Pittsburgh Student Chapter in forwarding a check for $10 to the corporation formed for financing Centennial of Engineering 1952, Inc., places it in the vanguard of local groups offering concrete financial support for the centennial program. Following a recent talk made by ASCE President Carlton S. Proctor at a luncheon meeting of Local Section and Student Chapter officers in Pittsburgh, the Chapter officers expressed their enthusiasm for the centennial program by approving a subscription of 50 percent of their total treasury funds ($20) to the program.

Engineers wishing to contribute to the centennial program either as individuals or in groups may forward their checks to the Centennial of Engineering 1952, Inc., 57th Street & South Shore Drive, Chicago 27, Ill.

ASCE President Carlton S. Proctor attends recent luncheon meeting of officers of Pittsburgh Section. Shown, left to right, are Park H. Martin, Mr. Proctor, Section President James P. Growdon, and Gen. Brehon B. Somervell, Hon. M. ASCE. In evening Mr. Proctor addressed Section's annual dinner meeting on ASCE Centennial plans.

The Surveyor's Notebook

Reporting on Unusual Surveying Problems and Their Solutions

Notekeeper: W. & L. E. Gurley, America's Oldest Engineering Instrument Maker

A Century in the Field

"We've both been land surveyors since 1901. Joe has been in every state in the Union, and I've hit all but Maine," Arthur Kidder of the famed cadastral engineering team of Kidder and Thoma was reminiscing at the American Society of Civil Engineers convention.

"Remember those early years out West for the General Land Office?" cut in Joseph Thoma. "We had some rough ones. Like that time in '05, laying out Government town sites on Untia Indian reservations in Northeast Utah. The Utes weren't too friendly. What did that one brave say? 'White man survey no good—cut up big Indian land into little pieces.' And then that sign: 'No Shooting Allowed—Surveyors and Other Animals in the Brush!'

"That job gave us early proof of the solar transit's value. With just a solar and a stadia rod, the two of us were making good time meandering the brushy banks of a river—both banks at once—to the amazement of a large party with regular transits, struggling with undergrowth and slippery banks on one side, and making plenty of mistakes. We finished our work quickly, and corrected theirs, too. That's one of the solar's biggest assets: checking on a precise traverse."

Land surveyors since 1901, Thoma and Kidder formerly worked for old Government Land Office.

Cadastral engineers Arthur Kidder (left) and Joe Thoma use four Gurley Telescopic Solar Transits.

"Joe, that reminds me of a few years ago in Washington," said Kidder, "when your friend had a misclosure on a 20-mile traverse up in Maryland and thought he would have to rerun the whole thing—at least three days' work with full party. You drove out with a Gurley Solar Transit, took azimuth readings at regular intervals, and found the error in three or four hours.

"We've run thousands and thousands and more thousands of miles, and believe a land surveyor can't afford to be without a Gurley Telescopic Solar Transit. We're finished before the ordinary party is set up. For four years now, we've had four Gurley solars. They have never needed adjustment, for the stability is built in."

"In our combined century in the field," concluded Joe Thoma, "we'd say the greatest progress in large-scale land surveying has been the development of the Gurley Telescopic Solar Transit. It will certainly aid in mapping the 200-million acres of public land still to be surveyed."

If you would like information on the Gurley Telescopic Solar Transit and other instruments, write for Bulletin 50. And send your story for a future "Surveyor's Notebook" page.

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NEWS BRIEFS . . .

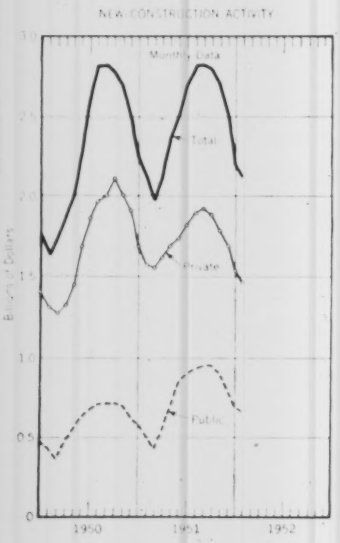
High Construction Level Continues in January

Construction activity maintained near record levels in January after allowance for seasonal factors, according to a joint report of the Building Materials Division of the U. S. Department of Commerce and the Labor Department's Bureau of Labor Statistics. The total value of new construction put in place during the month came to more than $2.1 billion—a slight rise above the January 1951 total, though a 4 percent decline from December. Substantial increases over the year in military, industrial, and public utility construction maintained the level of construction expenditures despite reductions in housing, commercial building, highway and other types of construction. School building activity was also higher than in January last year.

Total private outlays for new construction in the January just passed amounted to $1,100 million, a decline of 4 percent from December and 8 percent from the January 1951 total. The value of residential building, estimated at $720 million, was 20 percent below a year ago. The joint agencies note that the drop in homebuilding activity from 1950 record levels was halted, temporarily at least, by the middle of last year, and that since that time it has followed a seasonal pattern at a level around 20 percent below 1950.

Industrial and most other types of private nonresidential building advanced in January. The relatively high level of activity at this time is attributed to improved distribution of controlled materials for construction under way, and to a substantial volume of self certified work.

Total public expenditures for new construction during the month were estimated at $667 million, an increase of 31 percent above the January 1951 total. Military construction was nearly six times the January 1951 volume, industrial and residential building more than double, and school building up 14 percent from last year. Highway construction, however, was about 20 percent lower this January than last, and the remaining types of public works were down moderately.



Construction picture for January 4 percent below December total and slightly above January 1951 total is indicated in Department of Commerce curves.

Moles Give Annual Construction Awards

Experts in the construction industry packed the Moles' twelfth annual award dinner in New York on February 6 to join in honoring Stephen D. Bechtel and Charles B. Spencer, Members ASCE, for "outstanding achievement in construction." Considered the top honor for service to the construction industry, the awards are given annually by the Moles, a New York organization of heavy construction men.

Mr. Bechtel, president of the Bechtel Corp., San Francisco, was given the nonmember award. He was honored as "citizen, engineer, contractor, in recognition of his illustrious accomplishments during the war, and his notable leadership in the fields of oil refining, pipelines, dams, and shipbuilding construction." The association's member award went to Charles B. Spencer, president of the New York City firm of Spencer, White & Prentis, Inc., "in recognition of his preeminent pioneering work on new foundation methods and his outstanding accomplishments, notably in the fields of subway, tunnel, and dry dock construction." Mr. Bechtel's award was presented by Ben Morrell, Hon. M. ASCE, recipient of the Moles' 1943 non-member award, and the award to Mr. Spencer was presented by Richard E. Dougherty, Past-President of ASCE and recipient of the Moles' 1950 member award.

The Moles also presented honorary membership to Gen. Lucius D. Clay, Hon. M. ASCE, principal speaker of the evening. Former Army engineer and military governor of the American Zone in Germany, General Clay is now chairman of the board of the Continental Can Co. In his talk he advocated removing price controls as a way of increasing production. In his opinion the defense effort is less than 15 percent of our industrial strength.

Charles B. Spencer, member recipient of Moles award (left) and Stephen D. Bechtel, non-member winner (right), receive their awards from George F. Ferris, chairman of Moles Award Committee, at recent dinner in New York.

USBR Asks Bids for Folsom Power Plant

An invitation for bids for construction of Folsom power plant on the American River northeast of Sacramento, Calif., was issued by the Bureau of Reclamation in Denver, Colo., on February 12. Actual construction will get under way soon after the opening of bids in Folsom, Calif., on April 2. The plant, together with Folsom Dam now under construction by the Army Corps of Engineers (October 1951 issue, page 68), will be integrated with the Bureau's huge Central Valley Project in California.

Located at the base of the dam, the power plant will be 111 ft high and made of reinforced concrete. It will have three 54,000-kw generators and an average annual output of 240,000,000 kwhr. Water to drive each of the 74,000-hp hydraulic turbines will flow through penstocks embedded in three concrete-lined tunnels, each of which will be 15.5 ft in diameter and 200 ft long. About two and a half years will be required for construction.

Excavation work at the power plant site, being performed under a $1,463,721 separate contract with the Guy F. Atkinson Co., of San Francisco, is nearing completion.

Denver Turnpike Is Opened to Traffic

Dedication of the new 17.3 mile turnpike between Denver and Boulder, Colo., on January 19 marked the opening of the first toll road west of the Mississippi. The four-lane portland cement highway, with 20-ft median strip, replaces a winding, hazardous highway between the two cities, cutting about 8 miles and 30 min of travel time from the trip. It was built by the Colorado State Highway Department at a cost of $6,300,000 under Mark U. Watrous, state highway engineer. Howard, Needles, Tammen & Bergendoff, of New York and Kansas City, Mo., were consultants on design and construction of project, which was begun in November 1950.

Highway Steel Shortage Scored at ARBA 50th Annual Meeting

The need for highways and highway transportation to support the defense program is greater than ever before, Maj. Gen. F. A. Heileman, chief of transportation, Department of the Army, said in a leading address at the recent 50th annual convention of the American Road Builders Association in Houston, Tex. He noted that, "With respect to funds, the Department of Defense has supported all practical proposals for the improvement of the national system of interstate highways and other important highways. With respect to critical materials, the Department of Defense is in a different position. The Congress and the President have assigned to another federal agency the responsibility of determining the amount of the nation's resources that should be applied to the various requirements of defense."

Lagging highway construction was also criticized by A. C. Clark, deputy commissioner of the U.S. Bureau of Public Roads, who asserted that the federal-aid road system should complete about 43,000 miles of road a year. In the fiscal year 1951, he said, only 19,279 miles of such roads were completed, or only 45 percent of what was needed. He especially criticized the current problem of obtaining steel for highway work, citing figures on allocations asked by the Bureau which were slashed by the DPA despite assurance that the metal would go only to critically needed projects.

The importance of roadbuilding in helping the government's "Point Four" program of economic development in Latin America was stressed by George Taylor Ross, chief of the industry and government services division, Technical Cooperation Administration. He developed the theme that the economic and social values of highways must be given primary consideration in the development of any country.

Two resolutions drawn up in cooperation with the American Association of State Highway Officials urged that highways be declared an industrial facility in the allocation of steel, and that the scrap drive be supported through the state highway departments.

ARBA officers for 1951 carry over for 1952, with three exceptions: M. J. Hoffman, of St. Paul, Minn., replaces W. A. Roberts as vice-president of the Central District; and T. B. Hale of Chicago, and J. E. McCracken, of Bethlehem, Pa., replace Robert B. Brooks, M. ASCE, and A. R. Taylor, A.M. ASCE on the Board of Directors. Paul B. Reinhold, of Pittsburgh, Pa., is president of the group.

Puerto Rico Builds New Water Supply System

New Loiza River dam nearing completion near San Juan, Puerto Rico, will form large reservoir designed to assure adequate water supply for metropolitan San Juan for next 20 years. Expanded Loiza River development program will involve expenditure of around $8,000,000 and provide supply of 30 mgd. Filtration plant is already in operation, tapping accessory water supply areas. Dam is one of many projects under construction in Puerto Rico that will be of interest to engineers attending Inter-American Convention, sponsored by Puerto Rico Section, November 13-15.

Renegotiation Act to Be Handled by Board

Renegotiation of defense contracts subject to the 1948 Act will now be handled by the Renegotiation Board, according to an announcement from the Department of Defense. Delegation of powers and functions formerly exercised by the Secretary of Defense to the Board will place all defense contract renegotiation operations under one agency, simplifying matters for the contractor with contracts subject to both the 1948 and 1951 Acts. Personnel from the military renegotiation boards have been transferred so that defense contractors may continue to deal with persons with whom they have already worked on renegotiation matters.

Questions concerning the functions of the Board may be directed to the Renegotiation Board, General Services Administration Building, 7th and D Streets, S.W., Washington, D.C.

Organization Formed for Prestressed Concrete Work

Reorganization of its operation to function solely as an independent firm of consulting engineers in the design of prestressed concrete construction is announced by the Preload Company, Inc., of New York. The company now undertakes engineering commissions for any type of prestressed structure. It will prepare complete working drawings and specifications on which its clients can obtain competitive bids from general contractors, and provide engineering inspection during the progress of the construction. Its scale of fees is that recommended by ASCE for technical services of the kind.

The Preload staff includes Curzon Dobell, M. ASCE, president and general manager, and M. F. Fornerod, M. ASCE, chief engineer.

Highway Research Board Meeting Notes Need for Financing Studies

The need for research in the field of highway financing and taxation was stressed at the annual meeting of the Highway Research Board, held in Washington, D.C., January 14-18, with an attendance of more than 1,200. In a keynote address, Ralph A. Moyer, A.M.ASCE, chairman of the Board and research engineer and professor of civil engineering at the University of California Institute of Transportation and Traffic Engineering, outlined the critical financing situation facing highway administrators.

Roy W. Crum

C. S. Mullen

Deploring the growing gap between the tax revenue collected for financing highway construction and maintenance and the cost of construction and maintenance, Professor Moyer noted that some states are resorting to toll financing to bridge the gap. In his opinion, this method has limited application as a solution to the problem. He also criticized rates which tax highway user taxes as rendering a disservice to their population not only through their obvious failure to provide adequate highways but as representing "an open invitation to Congress to step in and collect high excise taxes while collecting is good."

The sufficiency rating procedure as a method of allocating highway funds on a priority basis was discussed in a lengthy symposium, headed by William E. Willey, of the Arizona Highway Department, which originated the procedure. Other papers dealt with highway materials, design, and construction, with a special session devoted to study of pavement marking materials and research. Comprehensive coverage was also given the traffic problem and its allied problem of parking. The technical proceeding, including more than 150 papers and reports, will be available later in printed form.

The meeting was dedicated to the late ASCE Director Roy W. Crum, for many years director of the Highway Research Board. Mr. Crum was posthumously awarded the board's Distinguished Service Award as well as the George S. Bartlett Award "for outstanding contribution to highway progress." Presentation of the Bartlett Award was made in duplicate to C. S. Mullen, M.ASCE, chief engineer of the Virginia Department of Highways.

Also honored during the meeting were Thomas J. Carmichael and Charles E. Haley, J.M.ASCE, who received the Highway Research Board award for the best paper on highway research published by the board last year. Their paper reported a study of the statistical measurement of relationships between vehicle, roadways, and traffic conditions.

Engineers Face Big Job in Building Radioactive Labs

There will be increasing demand for the construction of buildings specifically intended to house the many phases of atomic energy work, engineers and architects attending a recent two-day conference on Laboratory Design for Handling Radioactive Materials in Washington were told. The conference, which was conducted by the Building Research Advisory Board with joint sponsorship of the American Institute of Architects and the Atomic Energy Commission, took an important step toward acquainting the profession with the specialized problems created by the rapid expansion of radioisotope usage for agricultural, industrial, and medical purposes and the resulting need for establishing design criteria for such buildings.

The speakers threw light on such problems as laboratory layout and construction, shielding, surfaces and finishes, air supply and exhaust, and waste disposal. Flexibility of design was stressed, with a number of speakers mentioning the advantages of modular design in such buildings. Standardization of both design and equipment was cited as not only economically desirable but also more feasible.

The proceedings of the conference will be available in from three to four months and can be obtained from the Building Research Advisory Board, 2101 Constitution Avenue, N.W., Washington 25, D.C.

Government Order Increases Professional Engineer Pay

A recent order of the Salary Stabilization Board (GSO 8) authorizes payment of additional compensation to the "many professional engineers regularly required at the present time to work hours in excess of those contemplated in determining their current salaries." The professional engineer is defined as "a person employed in a professional capacity who, by reason of his special knowledge of the mathematical and physical sciences and the principles and methods of engineering analysis and design acquired by professional education and practical experience, is qualified to practice engineering."

The order continues, "An employer who on or prior to January 25, 1951, had a plan or practice of paying professional engineers additional compensation for hours worked in excess of a normal work week may continue to pay additional compensation to such employees in accordance with such plan or practice.

"An employer who did not have such a plan or practice may pay a professional engineer employed in a professional capacity, as distinguished from an executive, administrative, or outside salesman capacity, additional compensation during a regularly extended work week for hours worked in excess of the normal work week, but the additional compensation shall not, without approval of the Office of Salary Stabilization, exceed his straight time salary."

Airfield Construction in North Africa Pushed

Construction of five airfields in Morocco is being rushed as a cooperative project of the United States government and the French protectorate regime in Morocco. Begun seven months ago, the $300,000,000 project is being built by five civilian engineering firms forming a joint venture under the name of the Atlas Construction Co. They are the Morrison-Knudsen Co., Boise, Idaho; Ralph Mills, Frankfurt, Ky.; Blythe Brothers, Charlotte, N.C.; Nello Teer, Durham, N.C.; and Bates & Rogers, Chicago.

Two of the bases at Sidi Slimane and Nouasseur are already usable. Both have 11,000 ft runways. Ground is being broken for a third field, and two others are being staked out. Completion of all five bases late this year or early in 1953 is expected. Col. George T. Derby, district engineer for the East Atlantic District of the Corps of Engineers, heads the project.

Aerial Survey Expedites Raleigh, N.C., Mapping

With its rapid growth during the past decade pointing up the need for new maps for city planning and engineering purposes, the City of Raleigh, N.C., is having complete new mapping coverage to be executed by the Aero Service Corp., of Philadelphia. The aerial photography will require a week, with the aerial photos to be compiled in an accurate, controlled mosaic within 60 days after the flying is finished. The photo maps of the city and its environs will cover 60 sq miles at a scale of 1 in. to 600 ft. They will be supplemented by detailed topographic maps at a 5-ft contour interval and a scale of 1 in. to 200 ft, to be used primarily for engineering purposes.

A.E.D. Meeting Studies Construction Regulations

How to function effectively under defense regulations was the subject of much study by the 2,000 construction equipment distributors and manufacturers attending the recent 33rd annual meeting of the Associated Equipment Distributors in Chicago. Representatives of production and defense agencies were present to answer questions concerning priorities and regulations directed at them from members of the A.E.D. National Affairs Committee and from the floor. The pressing need for highway improvement was emphasized in special panel sessions and in the concluding business meeting. Principal speakers were Milton Rosen, Commissioner of Public Works of St. Paul, Minn., and Julian R. Steelman, president of the Koehring Co. Both deplored the severe curtailment of steel for highway construction as essentially dangerous to the defense program.

A resolution, directed at both manufacturers and the NPA, asked for balanced production of spare parts and new machinery. A second resolution expressed opposition to public construction by force account and recommended employment of the contract method on all government construction. Another resolution asked that Congress "practice every possible economy in its domestic and foreign expenditures and eliminate all unnecessary programs."

Harry J. Hush, vice-president and secretary of the Griffin Equipment Corp., New York, has been elected 1952 president of the A.E.D.

Titanium Metal Output Reaches Record High

Commercial production of titanium on a record tonnage scale in 1951 is announced by the U.S. Bureau of Mines and reported in the *Defense Production Record*. New records were also established for the production of ilmenite and titanium pigments.

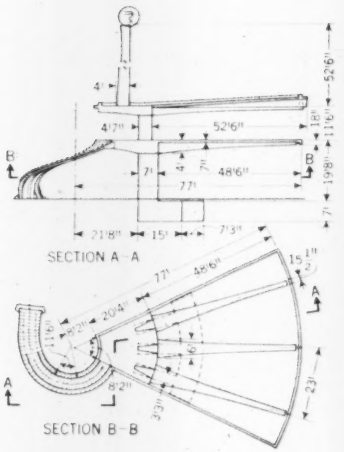
Titanium sponge was in production by the end of the year at an annual rate of about 1,400 tons, with actual output for the year estimated at 700 tons. Principal plants were operated by E. I. duPont de Nemours at Newport, Del.; Titanium Metals Corporation of America at Sayreville, N. J., Niagara Falls, N. Y., and Henderson and Boulder City, Nev.; and the Crane Co., at Chicago.

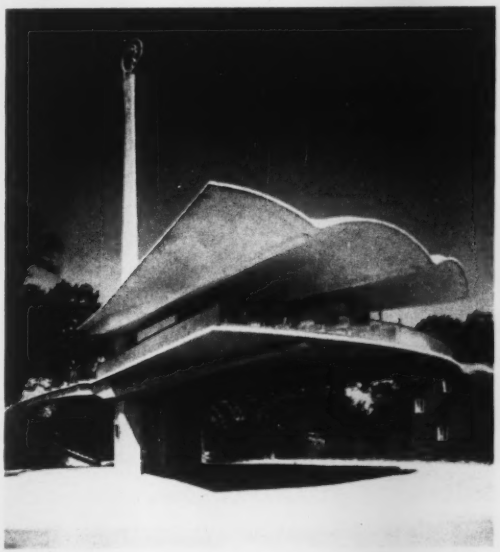
Water Picture for January

Above normal precipitation and stream flow in most sections of the country are reported by the U. S. Geological Survey in a January review of water resources. The principal exception noted is the Gulf State area, where low water is continuing with serious drought conditions in Texas and Oklahoma.

Extensive damage caused by heavy rains in California is attributed to overloaded drainage facilities and mudflows from steep hillsides rather than from overflowing streams. Most Southern California reservoirs received only small amounts of water, despite excessive runoff for the month. Runoff in major Arizona streams was the highest for the month since 1916. In the Northwest, a heavy accumulation of snow is reported in the high mountains, with flow of the Columbia above normal. In the four New England states of Rhode Island, Massachusetts, New Hampshire, and Vermont, precipitation for the month averaged about 20 percent of normal for the district. Stream flow was above normal for the third consecutive month. Reservoir levels were normal or above at the close of the month, and groundwater levels continued to rise, in most cases reaching record end-of-January stages.

German Structure Demonstrates Spectacular Use of Prestressing





Cafe erected last summer for the Builders' Exhibition at Hannover, Germany, strikingly demonstrates the potentialities of prestressed concrete. Footings, columns, 50-ft cantilevers and girders were all prestressed, as was the first-floor slab in transverse section. Designer was Dr. Finsterwalder, chief engineer for the building contractor, Dyckerhoff & Widmann, Munchen, West Germany.

Put Your Unused Scrap to Work

Have you unused scrap vital to the defense effort? Hundreds of tons of precious scrap are sorted and processed daily in Detroit yards of Woodmere Scrap Iron & Metal Company. Steel industry depends on such collections of scrap for at least 25 percent of its production.

Government Reopens Big Nickel Plant in Cuba

Reopening of the Nicaro nickel plant in Oriente Province, Cuba, to accelerate the defense program is announced by Jess Larson, General Services Administrator. Built during World War II at a cost of $32,000,000, the plant is one of the largest nickel producing units in the world. Four of its huge Herreshoff furnaces are now operating on a 24-hour a day schedule, and the other eight will be brought into production by June 1. Annual capacity of the plant will be about 30,000,000 lb.

A pilot plant is also being erected at Nicaro. If experiments made there are successful, steps will be taken to revise production processes leading toward an additional 10 percent, or 3,000,000 lb, recovery of nickel. Recovery of cobalt, another critically needed metal, will also be undertaken.

Reactivation of the plant is being handled by the General Services Administration, with the cooperation of four defense agencies. The Frederick A. Snare Corporation, New York City contracting company that built the original plant, is carrying out the rehabilitation work. Operation is under the Nickel Processing Co., a joint enterprise of N. V. Billiton Maatschappij, of The Hague, Netherlands, and the National Lead Company.

Steel Production Is at All-Time High in January

Steel production in January totaled 9,120,000 net tons, the highest ever attained in one month, according to the American Iron and Steel Institute. This output was almost 277,000 tons greater than the January 1951 output and 234,871 tons above the revised December production of 8,885,129 tons. The largest previous monthly output, in October 1951, was 4,000 tons less.

The Institute places the revised output for 1951 at 105,134,553 tons.

Construction Problems Studied by Chamber of Commerce Group

A critical appraisal of construction industry problems, made at a recent conference of the Construction Industry Advisory Council, led to the conclusion that as a bolster for the national economy the industry must be maintained to the maximum extent consistent with defense demands. Created by the Chamber of Commerce of the United States to formulate policy for the industry, the council consists of more than a hundred national construction trade and professional organizations.

Immediate planning for post-mobilization construction was strongly urged by Norman J. Schlossman, Chicago architect, and Bertram D. Tallamy, A.M. ASCE, superintendent of the New York State Department of Public Works and president of the American Association of State Highway Officials. Speaking for public works, Mr. Tallamy said, "I must point out that we are far behind in keeping up with national needs in roads, schools, hospitals, and the like. Our roads are entirely unable to carry safely today's total of nearly 50,000,000 motor vehicles. An almost insuperable problem is presented in the deficit of national highway facilities. We are fifteen years behind schedule, and the average life of a highway is only twenty years. The same situation exists with respect to schools and many other types of public construction."

Defense Mobilization Director Charles E. Wilson told the conference that the defense production peak should be reached within the year and that it would probably level off at about $50,000,000,000 annually. If held to that figure and if production facilities are increased as hoped, the construction industry should be able to get more materials than is possible now, he said. He promised the group that projects once started would have materials for completion, as asked in the policy resolution adopted by the conference.

Technical Aid Program Hailed at UNESCO Meeting

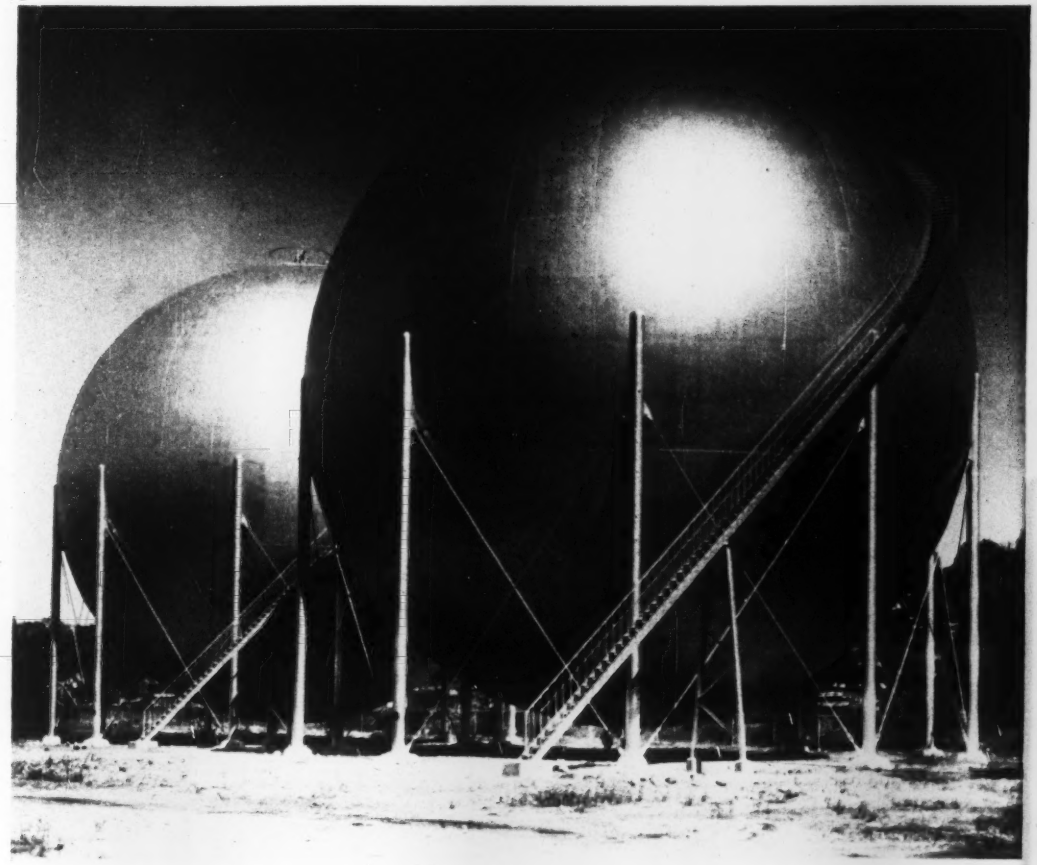
The UNESCO technical assistance program was termed the "first global crusade" ever aimed at "doing something for the two out of every three persons in the world who never had a chance," at the Third National Conference of the U. S. National Commission for UNESCO, held at Hunter College in New York, during the last week in January. The statement was made by Dr. Malcolm S. Adiseshiah, director of Technical Assistance for UNESCO, who spoke at a session devoted to UNESCO's contribution to the global aid program. It is essential, he said, that countries participating in the program of technical assistance pool their resources, if the program is to be maintained.

A technical assistance report, which served as a basis for the panel discussion, shows that 1,000 experts are expected to be available by the spring of 1952 for work in the program aimed at underdeveloped countries. A similar number of citizens of the countries in which the program will operate will also have training opportunities in countries other than their own, the report states.

AEC Renews Eniwetok Proving Ground Contract

The Atomic Energy Commission has renewed its contract with Holmes & Narver, Inc., of Los Angeles, Calif., for design, construction, and operation of test site facilities at the Eniwetok Proving Grounds in the Marshall Islands. Under the terms of the new 18-month contract, the firm will continue to perform engineering and construction, camp operation and management, maintenance, and other services. Performance of the contract will be supervised by Paul W. Spain, manager of the Eniwetok Field Office, with operation from both the Santa Fe Operations' headquarters of the AEC in Albuquerque, N. Mex., and a field headquarters in the Eniwetok area.

In addition to the Eniwetok project, Holmes & Narver, Inc., has also engaged in extensive work for the Department of Defense in Okinawa, Hawaii, and the Island of Kwajalein.



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Plants in BIRMINGHAM, CHICAGO, SALT LAKE CITY, and GREENVILLE, PENNA.

Natural Gas Pipeline Readied for Mississippi Crossing

Construction crews of Midwestern Constructors, Inc., Tulsa, Okla., prepare to cross 3,000 ft of unpredictable Mississippi River water between Wittenberg, Mo., and Grand Tower, Ill., with three separate lines of 20-in. pipe, last link in 1,340-mile pipeline carrying natural gas from Texas Gulf Coast to Chicago. As pipeline was being put together in long sections prior to river crossing, it lay across tracks of Illinois Central Railroad. Photo shows dragline derrick, with help of sideboom tractors, lifting pipe-end so train can pass underneath. Operation of dredges, derricks, winches and sideboom tractors required in dredging river bottom (handled by McWilliams Dredging Co., New Orleans) and placing pipe was facilitated by wire rope made Jones & Laughlin Steel Corp. Underwater pipeline is of laminated construction, which eliminates necessity for river clamps, in addition to providing extra protection against corrosion. Wood mats were wired around pipe, over enamel covering, for protection in handling.

DPA Allotments for Second Quarter Cut Civilian Production

Second quarter allotments of steel, copper, and aluminum to the nation's industry, reported in the *Defense Production Record*, official bulletin of the Defense Production Administration, "will divert increasing amounts of these metals to the defense program and further cut civilian production."

Major policies governing second quarter allotments include support, at the highest possible levels, of strategic defense related work, such as the power expansion, atomic energy, and coke oven programs. Allotments for common components have been increased to support a balanced program of end items, to insure the completion of authorized construction projects, new industrial plants, and essential industrial machinery.

The amount of over allotment has been reduced following indications that previous over allotments were too great. Second quarter over allotments are as follows: Carbon steel, 110 percent; structural steel, 100 percent; steel plate, 105 percent; alloy steel, 112 percent; stainless steel, 115 percent; copper brass mill products, 105 percent; copper wire mill products, 105 percent; copper foundry mill products, 110 percent; and aluminum 105 percent.

Three categories of essentiality have been established for allotments for industrial equipment. They are (1) military, atomic energy and important defense related programs such as power expansion and petroleum refining; (2) important industrial production and agricultural programs, such as the production of heavy cotton pickers, conveying equipment and trucks; and (3) deferrable production, such as textile, baking, laundry, and some types of food processing equipment.

The reduced allotments will mean sharp reductions in construction from the first to the second quarter, preventing support of even the industrial expansion program at previous levels. To continue construction for industrial expansion now under way would require about 275,000 tons of structural steel in the second quarter, whereas only 213,000 tons have been allocated—a 23 percent slash.

Private homebuilding can be supported only at a level of about 600,000 new construction starts this year in comparison with about 1,000,000 in 1951. DPA emphasizes that its responsibility is merely in allotment of materials and not in the limitation of construction starts. Conservation measures and utilization of materials already in inventory are advocated as a means of producing more housing units than would otherwise be possible with the cut in allotments. Commercial construction, such as public buildings, retail stores, and similar less essential structures, will be cut considerably except in critical areas where badly needed.

Military Allotments

Allotments of structural steel to the military were increased from 171,000 tons in the first quarter to 240,000 tons in the second, and of copper brass mill products from 240,000,000 lb in the first quarter to 240,000,000 lb in the second. Aluminum allotments were also boosted, but allotments of copper wire mill products were reduced from 308,000,000 lb to 280,000,000 lb to furnish more copper wire for the production of electrical equipment, metalworking machinery, mining machinery, school and hospital needs, and general hospital equipment.

Pittsburgh Company Places Steel Mill Order

Award of a $2,000,000 order for the main roll and auxiliary drive electrical equipment for the Pittsburgh Steel Company's new 66-in. four-strand tandem cold strip mill at Allenport has been made to the Westinghouse Electric Corporation, of Pittsburgh. The order includes provision for two, 1,500-hp motors for stand No. 1 and six 2,250-hp for stands 2, 3, and 4, marking the first installation of twin motor drive on all stands of a tandem cold strip mill.

The mill, which is scheduled to begin regular operation in the summer of 1953, is designed to operate at a maximum delivery speed of 3,400 fpm, and to produce sheet gauge strip from 0.015 to 0.056 in. thick and from 24 to 62 in. wide.

AISC Elects New Officers for 1952

At the annual meeting of the American Institute of Consulting Engineers, held on January 14, the following engineers were elected officers for 1952: Carroll A. Farwell, Boston, Mass., president; George S. Richardson, vice president, Pittsburgh, Pa.; William H. Mueser, New York City, vice president; Clinton D. Hanover, Jr., New York City, secretary, and George C. Diehl, New York City, treasurer. All are ASCE Members. Elected to the Council for a three-year term are Charles E. DeLeuw, M. ASCE, Chicago; and Richard E. Dougherty, Past President ASCE, and John P. Hubbell, New York City.

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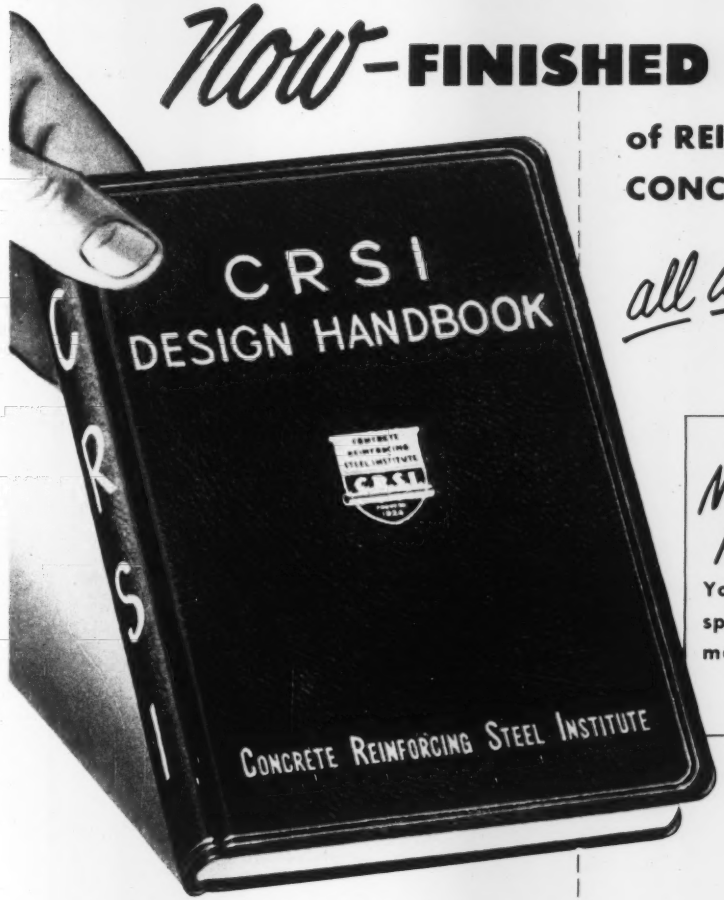

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Neale's N. C. COLUMN

R. Robinson Rowe, M. ASCE

Ever since our January meeting," confessed Professor Neale, "I've been worried for fear there might really be a Surplus Personnel Administration in Washington, and that the SP Administrator would actively resent my bit of whimsy, but I haven't heard a complaint."

"Then listen to mine," pleaded Joe Kerr. "Let a be the humble number of employees in 1944 and $a + b$ the addition at the beginning of 1945 to more than double the staff. Thereafter each annual addition equalled the sum of the preceding two, so I easily tabulated additions and cumulative totals in terms of a and b. Pertinent items are:

Year	Addition	Cumulation
1944	a	a
1945	$a + b$	$2a + b$
1946	$2a + b$	$4a + 2b$
1947	$4a + 2b$	$7a + 4b$
1948	$7a + 4b$	$12a + 7b$
1949	$12a + 7b$	$20a + 12b$
1950	$20a + 12b$	$33a + 20b$
1951	$33a + 20b$	$54a + 33b$
1952	$54a + 33b$	$88a + 54b$
1953	$88a + 54b$	$143a + 88b$
1954	$143a + 88b$	$232a + 143b$
1955	$232a + 143b$	$376a + 232b$
1956	$376a + 232b$	$609a + 376b$
1957	$609a + 376b$	$986a + 609b$
1958	$986a + 609b$	$1596a + 986b$
1959	$1596a + 986b$	$2583a + 1596b$
1960	$2583a + 1596b$	$4180a + 2583b$
1961	$4180a + 2583b$	$6764a + 4180b$

"You gave two relations which can now be expressed as

$$143a + 88b = 11(13a + 8b)$$

$$986a + 609b = 29(34a + 21b),$$

so I said 'Eureka!' All I have to do is solve these two equations for a and b and substitute in the last formula to find the required number of employees in 1961.' But the equations cancelled out. Now I'm mad!"

"You'll be madder in a minute," predicted Cal Klater. "When Noah spoke of the 1952 employees in the SPA, he told us the *number* of employees *now*, and from the coincidence, Joe mistook the number for the date. Using Joe's table

$$88a + 54b = 1952$$

which is a diophantine with the general solution

$$a = 5 - 27n, b = 28 + 44n$$

for which $n = 0$, $a = 5$, $b = 28$ is the only solution in positive integers. Substituting $6764a + 4180b$ gives 150,860 for the number of gold bricks in the SPA in 1961."

"Quite so," conceded the Professor. "In fact quite, quite so. These are fibonacci series for which there are many interrelations. In the key series 1, 3, 4, 7, 11, 18, 29, 47, 76, . . . I have underscored alternate members. Multiplied by alternates of the "addition" series, the products are alternate alternates of the "cumulative" series. The 11 and 29 were interjected to foil Joe, the 76 gives the answer, $76 \times 1952 + 5 + 28 = 150,860$. Now I'll call Flo Ridan our Guest Professor again to cool Joe off with an easy teaser."

"I'll soothe him," promised Flo. "A father left a triangular tract to his three daughters, one of whom had just married, asking that they divide it into three triangles of equal perimeter. The sides of the tract being 13, 14, and 15 chains, the lots were unequal, and the will seemed inequitable, except that the areas were proportional to the sizes of the three families of the daughters. I'm asking Joe to survey the division and Cal the sizes of the families."

(Cal Klaters were Guest Professor Flo Ridan (Charles G. Edson), Stoop (John L.) Nagle, George C. Stewart, Rudolph W. Meyer, Keith Jones, Sauerdoe (Marvin) Larson, Oldcutantry (Warner Harwood), R. E. Phillco, Charles W. Trigg, and Thatchrite (Guy C. Thatcher).)

AEC Announces Contract for Nuclear Research

An expanded program of research and development in the field of nuclear materials will be undertaken by Sylvania Electric Products, Inc., under a new contract from the Atomic Energy Commission. The work, which will have application in both the military and non-weapon fields, will be carried out by the company's new Atomic Energy Division at Bayside, N.Y. Walter F. Kingston will head the expanded program.

Army Map Service Opens Cincinnati Field Office

To expand map production for the Armed Forces, the Army Map Service of the Corps of Engineers has activated a field office at Cincinnati, Ohio, according to an announcement from Lt. Gen. Lewis A. Pick, M. ASCE, Army Chief of Engineers. Civilian personnel for the office, which will have its headquarters at 528 Walnut Street, are being recruited locally. The work will include drafting, cartography, and compilation of maps.

NEW IN EDUCATION

The American Institute of Steel Construction announces that ten $1,000 scholarships will be awarded in 1952 to high school seniors desiring a career in civil engineering. The winners will be selected from nominations which will be submitted by steel fabricating companies from all over the United States. Winners may use their scholarships at any one of 125 accredited colleges in the country offering degrees in civil engineering. Applications for scholarships will be accepted up to April 15. Inquiries should be addressed to the American Institute of Steel Construction, 101 Park Avenue, New York 17, N.Y.

Two engineering scholarships have been established at the Illinois Institute of Technology by Ceco Steel Products, Corp., of Chicago. Each scholarship provides $1,000 for the junior and senior years to a student enrolled in the civil engineering or general engineering curriculum, with continuation of the scholarship through the senior year dependent upon the student's record. Scholarship winners will be offered employment at Ceco's Chicago plant for eight or more weeks during the summer.

Designed to permit specialization in the use of a wide variety of materials, a new program leading to the degree of Bachelor of Science in Materials Engineering is now available in the College of Engineering at the University of Michigan. Materials studied include cements, wood, plywood, metals, rubber, and plastics. Emphasis is placed upon the corrosion resistance of these materials and their various protective coatings, such as paints, varnishes, lacquers and enamels.

Harlan H. Hatcher was recently installed as president of the University of Michigan. ASCE was represented at the inauguration ceremonies by Clyde L. Palmer, then president of the Michigan Section.

Tau Beta Pi is offering fellowships for graduate study in engineering during the 1952–1953 school year in the amount of $1,200 each, with remission of most or all of the tuition fees. Full information can be obtained from Paul H. Robbins, Director of Fellowships, 1121 Fifteenth Street, N.W., Washington 5, D.C.

To meet the increased need for engineers with knowledge of planning methods and techniques, the College of Engineering at Rutgers University is offering a curriculum leading to the degree of Bachelor of Science in Planning Engineering. The new program will incorporate courses in city and regional planning with a basic core of engineering subjects. Address inquiries to the Dean, College of Engineering, Rutgers University, New Brunswick, N.J.

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DECEASED

Lyle F. Bellinger, Former Society Officer, Dies

Lyle F. Bellinger (M '04) lieutenant commander, CEC, U S Navy (retired), Atlanta, Ga., died at the Veterans' Hospital at Chamblee, Ga., on February 1, at the age of 85. He was a graduate of Cornell University. The oldest officer in the Civil Engineer Corps, Commander Bellinger was in the Navy from 1901 until his retirement in 1931. He had been in charge of the construction of important facilities for Navy yards at Brooklyn, Newport, New Orleans, and at many other stations. Before he was commissioned in the Navy, he was with the Army Corps of Engineers, commanding the 3rd U S Volunteer Engineers in Cuba during the Spanish-American War. From 1892 to 1899 he had an engineering practice in Atlanta. Commander Bellinger had been active in the Georgia Section and was Vice President of ASCE in 1937 and 1938.

Lyle F Bellinger

Harry Edward Beister (J M '30) assistant county highway engineer for the Board of County Road Commissioners of Kalamazoo, Mich., died on January 20. He was 27. Mr. Beister was a recent graduate of the University of Michigan.

Carroll Phillips Bassett (M '88) retired consultant of Summit, N J., died at his home there on January 9, at the age of 88. For a number of years president and treasurer of the Commonwealth Water & Light Co., and later the Commonwealth Land Co., of Summit, Mr. Basset had erected water works, electric light, drainage, and sewage disposal plants in New York, New Jersey, and other states. He received his civil engineering degree from Lafayette College in 1883, and later did advanced work there for C E. and Ph.D. degrees. Lafayette also gave him an honorary doctorate of science.

Lynne John Bevan (M '15) consultant and specialist in hydraulic engineering, died in Pasadena, Calif., on January 29, at the age of 70. From 1906 to 1927 Mr. Bevan served as assistant engineer and later principal engineer for Vicle, Blackwell and Buck, construction hydraulic engineers, of New York. He entered private practice in 1927, maintaining an office first in New York, and then in Pasadena. He is a graduate of the University of Chicago and the University of California and lectured on water power engineering at the Polytechnic Institute of Brooklyn.

Chester Salisbury Allen (A M '10) chairman of the board and former president of Lockwood Greene Engineers, Inc., New York, N Y., died at Auburndale, Mass., on January 6 at the age of 70. Connected with Lockwood Greene from 1910 until his retirement in 1950, Mr. Allen had supervised construction of the company's projects here and in Europe and South America. Prior to 1910 he had been in South America for the United Fruit Co. and associated with Sanford E. Thompson as consulting engineer in editing various texts on reinforced concrete. He studied engineering at Brown and Cornell universities.

George Douglas Andrews (M '27) who headed the engineering firm of G. Douglas Andrews Associates in Towson, Md., and Harrisburg, Pa., died at his home in Baltimore, Md., on January 9. He was 59. A graduate of Lafayette College and combat veteran of World War I, Mr. Andrews had been with the New York contracting firm of Merritt-Chapman & Scott, and later was named PWA administrator for Pennsylvania. More recently he was consulting engineer to the Brazilian government, project manager on construction of the $31,000,000 Layhawk Ordnance Works built by the Army in Kansas in World War II; and (1944 to 1947) chief engineer of the Baltimore County Metropolitan District.

Robert W. Clark (M '40) city engineer of Meriden, Conn., and president of the Rockwell Silver Co., died suddenly there on January 15, at the age of 63. From 1911 to 1920, Mr. Clark held several positions with Fred T. Ley and Co., contracting firm of Springfield, Mass., New York, and Boston, and from 1920 to 1934 was president and treasurer of his own construction company, with headquarters in Waterbury, Conn., and a branch in Asbury Park, N J. He then turned to state government administration in New York and Connecticut, including the business management of the Connecticut State Highway Department. He was appointed city engineer in 1950.

Eugene Frank Dugger (M '43) general manager of the Newport News Water Works Commission since 1926, died on December 29, at 54. He had previously been assistant superintendent of the Newport News Light and Water Co., in charge of distribution plants, sewers and meters. Mr. Dugger studied engineering at Fresnilum College, Greenville, Tenn.

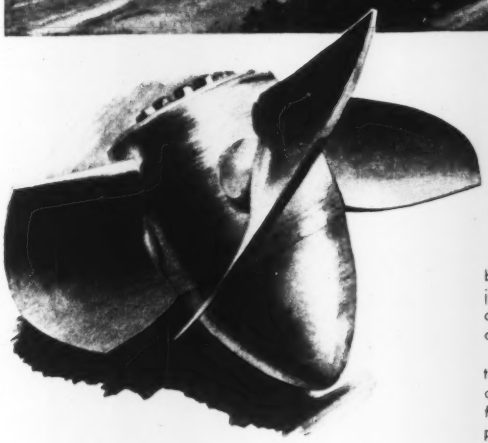
E. Kemper Carter (M '44) chairman of the board of the Carter Waters Corp., Kansas City, Mo., died in that city on December 23, at the age of 67. A civil engineering graduate of the University of Missouri, Mr. Kelly had been assistant city engineer of St. Joseph, Mo.; city engineer and superintendent of the water works at Liberty, Mo.; and engineer-representative for the Sinclair Refining Co., in Chicago. In 1921 he founded his own construction materials firm, the E. K. Carter Co., forerunner of Carter Waters. He was president of the company from 1922 to 1940. A veteran of World War I, Mr. Carter maintained an active interest in veteran and military organizations.

Granville Lewis Taylor (M '11) retired engineer of Claremont, Calif., died at his home there on January 26, at the age of 73. Joining the newly formed McClintic Marshall Co., at its Pottstown (Pa.) plant, Mr. Taylor became an executive engineer and authority on the economics of fabricated steel structures. He was chief engineer of the company with offices in Pittsburgh, from 1920 until 1929 when illness forced his retirement. During this period he was responsible for construction of the New York Central's Alfred H. Smith Memorial Bridge at Castleton, N Y. Mr. Taylor was educated at the University of Pennsylvania.

John Titreville Campbell (M '24) consulting engineer of Pittsburgh, Pa., died suddenly on December 24, at the age of 64. Following his graduation from the University of Pittsburgh in 1910, Mr. Campbell was successively employed by the Pennsylvania Railroad, the Pittsburgh Bureau of Water, and the American Water Works and Guarantee Co. In 1915 he became connected with Chester & Fleming (now the Chester Engineers) of Pittsburgh, and since 1919 had been a partner in the firm. His work included extensive sewerage and water projects all over the country.

Edward A. Dougherty (M '46) since 1945 chief engineer of the New York Central System, Chicago, Ill., died in that city on February 27, at the age of 65. Mr. Dougherty had been with the New York Central in various capacities since his graduation from the Columbia University School of Mines in 1910. At the time of his death he was serving on the executive committee of the ASCE Centennial Celebration Committee and as a director of the Centennial of Engineering, 1952.

Anton Edward Horst (M '30) president and treasurer of the Henry W. Horst Co., Philadelphia, Pa., died in Verona, N J., on January 5, at the age of 66. Upon his graduation from the University of Illinois in 1911, Mr. Horst became connected with his father's firm, which was incorporated under its present name in 1914. He served as secretary, treasurer, and general manager, and since 1940 had been president of the firm, which built important projects all over the country. During the recent war he spent 31 months in Washington as zone chief and later chief for the Corps of Engineers in connection with the renegotiation of contracts, receiving a citation for meritorious civilian service. Long active in the Associated General Contractors of America, Mr. Horst served as twelfth president of the organization.



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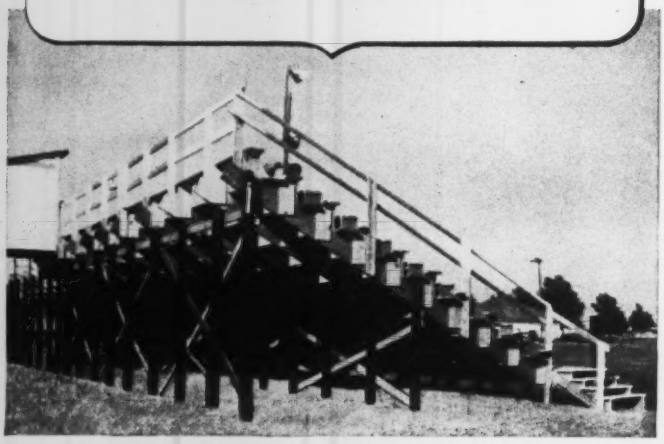

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Norman Augustus Swan (A.M. '24) of Pembroke, Bermuda, died on November 8, 1951, at the age of 69. Beginning in 1908, Mr. Swan was for many years connected with the Department of Public Works of the Dominican Republic, with headquarters at Santo Domingo. He was in charge of surveys, and later served as assistant engineer.

Hilliard Galbraith Haynes (A.M. '45) for 23 years associate professor of civil engineering at The Citadel, Charleston, S.C., died on November 25. He was 56. Before joining the faculty of The Citadel, he worked for the City of Pittsburgh Division of Design, W. N. Willis, Engineers, and the Harwood-Beebe Co. Professor Haynes, active in professional affairs, and ASCE Faculty Adviser for The Citadel Student Chapter, graduated from Wofford College and Carnegie Institute of Technology.

David McCoach, Jr. (M. '38) major general, retired Army engineer and vice-president of the Charles H. Tompkins Construction Co., Washington, D.C., died on December 15, at the age of 64. After graduation from the U.S. Military Academy, he entered the Corps of Engineers and served as district engineer at Pittsburgh, Detroit and New York. Prior to World War II, he was in charge of air-base construction in the Caribbean; and during the war was chief engineer of the Mediterranean theater aiding the landings in southern France. He has been Assistant to the President of the Mississippi River Commission, a member of the War Department General Staff, and was engineer commissioner of the District of Columbia from 1928 to 1941.

David McCoach, Jr.

Harry Joseph Kelly (M. '29) who just retired as manager of the construction and maintenance division of the Gulf Oil Corp., Pittsburgh, Pa., died suddenly on January 21. His age was 61. A civil engineering graduate of Texas A. & M. College, Mr. Kelly served as a captain of Infantry in World War I. His association with the Gulf Oil Companies began in 1916, when he was employed in the construction division of the Port Arthur, Tex., refinery.

Parker O. Wright (M. '10) architect and architectural engineer of Pasadena, Calif., died there on January 11. His age was 79. Specializing in the design and construction of schools, hotels and office buildings, Mr. Wright was in private practice from 1911 to 1934, and from 1940 on. He was the supervising architect for the Isthmian Canal Commission in Panama, and architect on the Coolidge Dam, Arizona, and he served the state of California in many capacities. He received his degree from Cornell University.

John Earl Morelock (M. '23) retired engineer of Chattanooga, Tenn., died in Gainesville, Fla. He was 65. After studying at the University of Tennessee and the University of Washington, he became deputy county engineer for Snohomish County, Wash., then chief draftsman for the Chattanooga Iron & Wire Works, Chattanooga, Tenn. From 1912 on he was with the Converse Bridge & Steel Co. of Chattanooga, advancing to vice-president and director of the company.

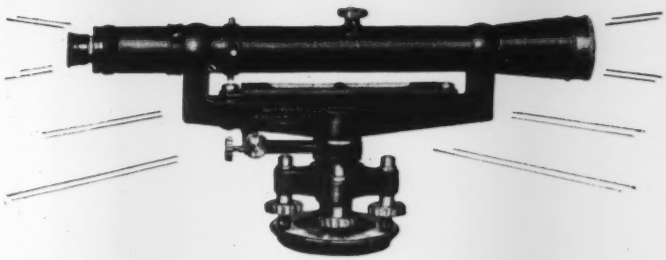
Jabez Curry Nelson (M. '37) retired president and chairman of the board of the Easy Washing Machine Corp., Syracuse, N.Y., died at his home in that city on January 22. He was 67. With the company from 1920 until his retirement in 1950, Mr. Nelson began his engineering career with Ford, Bacon & Davis in 1905, and later was general manager of the Gary & Interurban Railway, Gary, Ind., and president and general manager of Empire State Railways at Syracuse. He was an alumnus of the University of Alabama and had done graduate work at Cornell University.

Merton Towne Staples (M. '49) engineer of New York City died in Norfolk, Va., at the age of 53. He had worked in the capacity of field and resident engineer for the Massachusetts Department of Highways; the Pitometer Co., New York City; Stone & Webster, Boston; the Oakdale Contracting Co., Inc., and the Cornell Contracting Co., both of New York City. Mr. Staples, an alumnus of Northeastern University, was last connected with C. M. Guest & Sons at Anderson, S.C.

Anthony Carmen Certo (J.M. '48) died in August 1950 at the age of 30, according to information recently forwarded to Society headquarters. Mr. Certo, who was educated at the University of Pittsburgh, served as a surveyor in the U.S. Army during World War II and after his discharge was employed as junior field engineer for the Dravo Corporation, Pittsburgh, Pa.

Harry Earle Wilcox (A.M. '38) civil engineer of Edinburg, Tex., died there, in October, at the age of 62. After graduating from Michigan State College in 1912, Mr. Wilcox began his career as a resident engineer on construction work in Canada and Utah. From 1914 to 1918 he evaluated railway property for the Interstate Commerce Commission. After that he entered the general practice of engineering and contracting in southern Texas.

Ned Hensel Sayford (M. '16) who retired recently after 18 years as chief of the Maps and Surveys Branch of the Tennessee Valley Authority, Chattanooga, Tenn., died on February 5. He was 67. Widely known for his contributions to surveying and mapping techniques, Mr. Sayford was awarded honorary membership in the American Congress on Surveying and Mapping in 1951. Before joining the TVA staff, Mr.



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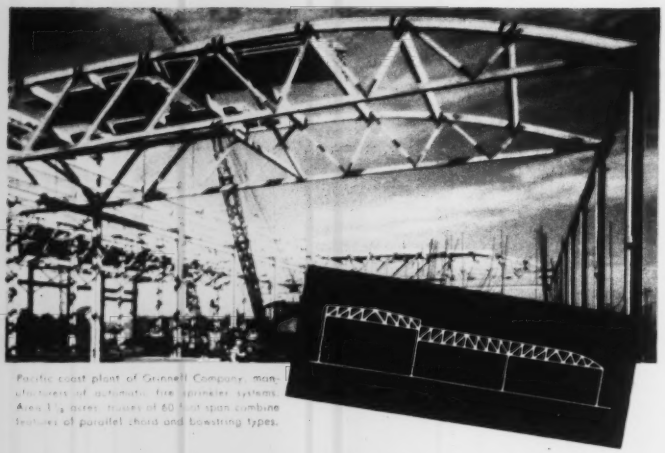

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Sayford was for a number of years vice-president of the Morgan Engineering Co., at Memphis, Tenn. He was a graduate of Lehigh University.

Karl Barclay Kumpe (A.M. '15) president of Kumpe Hauser Corp., and Karl B. Kumpe Ltd., died in Paris while touring Europe. He was 70. Early in his career he worked for several mining companies and railway lines in the United States, Alaska and Canada. He was vice-president of the Linden Kibbe Construction Co., manager for J. C. Maguire, Contractors and the Pacific Lock Joint Pipe Co. Mr. Kumpe, who attended Gonzaga College and Purdue University, was concerned with the building of the Long Beach Harbor breakwater, outer port jetties and the Rainbow Pier.

Roy Dexter Tyler (A.M. '07) retired engineer, died in Gainesville, Fla., at the age of 75. Mr. Tyler, who studied engineering at the Chase School of Applied Science, was connected with the Lake Shore & Michigan Southern Railway Co., in the early part of his career. Later he served at various periods as general superintendent with Montgomery Ward, St. Paul, Minn., New York district sales manager for the Modine Manufacturing Co., and as senior engineer in the Boston Ordnance District of the War Department at Boston, Mass.

NEWS OF ENGINEERS

Abraham M. Aloff received his law degree from Boston University Law School in June 1951 and was recently admitted to the Massachusetts Bar.

W. R. Engstrom, of the Austin Co., is returning to Seattle as vice-president and manager of the Pacific Northwest District, after service for the company in various parts of the country. **Richard Ellis** will continue as vice-president and Seattle District manager on his return from an extended vacation. Additional responsibilities have been designated to **Edmund J. Goodheart,** as assistant project manager, at the AEC facilities operated by the Dow Chemical Co., near Denver.

William R. B. Froehlich, chief engineer of the Regional Planning Association, was chosen as executive director of the Public Parking Authority, Pittsburgh, Pa. Mr. Froehlich is secretary-treasurer of the Pittsburgh Section.

Robert Henry Clinger is assistant engineer for Dallas County, Tex.

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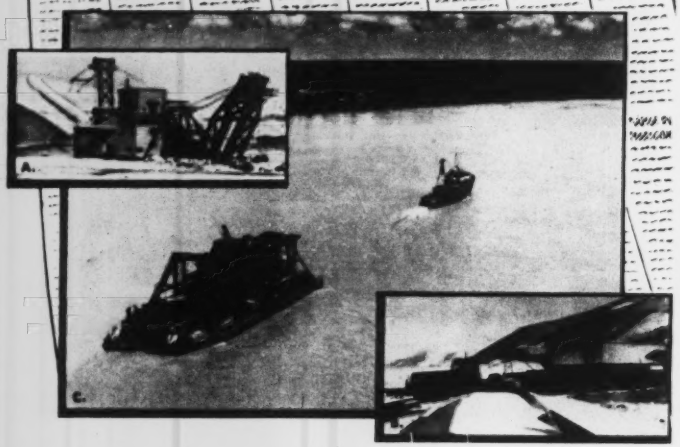

A. YUBA No. 152, originally built with 10 cu. ft. buckets and 80-ft. digging depth for Emigrant Dredging Co., dredging gold in Montana, 1941.

B. YUBA crew dismantled No. 152 for new owners, Nechi Consolidated Dredging, Ltd.; moved it by truck and rail to New Orleans, there rebuilt it for ocean tow to Colombia.

C. YUBA No. 152, now renamed Santa Margarita, enroute to Colombia. Changes in structure and equipment to fit the new ground were made during move and rebuilding.

If you, like Nechi Consolidated Dredging, Ltd., need a dredge moved or rebuilt—YUBA can help you. We are dredge specialists with more than 40 years of experience in designing, building, moving, and rebuilding. YUBA-designed dredges are used to handle all sorts of alluvial material—for building dams, canals, levees, etc., and in digging such minerals as monazite, ilmenite, scheelite, cassiterite, platinum, gold, zirconium, garnets and sapphires.

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46.

Bruce A. Hainsworth has joined E. R. Squibb and Sons, New Brunswick, N. J., to head their newly created division of engineering. Formerly district chief engineer of the H. K. Ferguson Co., of Cleveland, Mr. Hainsworth has been connected with the design of the Vigo Ordnance Plant, Terre Haute, Ind., a cholormycetin plant, a penicillin plant, and seven chemical plants for the Chemical Warfare Service.

John B. Ecker has been appointed general manager of the Capital Transit Co., Washington, D. C. He began as an assistant engineer for the firm in 1929, and was successively promoted to the positions of research engineer and assistant general manager.

Coverdale & Colpitts, New York City consulting firm, announces the admission to partnership of **Samuel P. Brown** and **G. Harold Warfield.**

Robert Edmonston has transferred from Sacramento, Calif., to the Los Angeles office of the California Division of Water Resources. He is assistant hydraulic engineer.

W. W. DeBerard, Honorary Member of ASCE and chief filtration and engineer for the City of Chicago, and **Harry E. Jordan,** secretary of the American Water Works Association, were honored for their outstanding performance in the production of safe and potable water by Northwestern Technological Institute at the recent Northern Illinois Water Works Institute.

Henry J. Brunnier, consulting structural engineer of San Francisco, was nominated for president of Rotary International for 1952-53 by the committee on nominations.

Ralph Budd, Henry T. Heald, and **Arthur E. Morgan** were among seven civil engineers and railroad men of the northwest presented with "Centennial Awards for the Northwest Territory" at Northwestern University's centennial convocation.

Robert N. Clark has accepted a position as Chief of Environmental Sanitation at the World Health Organization's headquarters in Geneva, Switzerland. Previously, Mr. Clark was chief of the Public Health Engineering Branch of the TVA Division of Health and Safety.

Frederick W. Cron, resident engineer for the U. S. Bureau of Public Roads at Gatlinberg, Tenn., for several years, was transferred to the Philippines in the early part of the winter.

Gabriel O. Wessenauer, acting manager of power for the Tennessee Valley Authority at Chattanooga, Tenn., has been named by the Defense Production Administration to a committee to recommend a program for electric power expansion for defense needs.

Wallace G. Davis, captain, Corps of Engineers, has been appointed officer-in-charge of the Laredo Field Office of the Galveston District, Corps of Engineers.

G. Brooks Earnest

G. Brooks Earnest, dean of engineering at Penn College, has been named acting president of the institution. An active member of the Society, Professor Earnest is a past-president of the Cleveland Section and is now a Director of ASCE. A Case Institute of Technology graduate of 1927, he was a member of its faculty for 20 years.

Henry G. Gerdes, colonel, Corps of Engineers, Camp Carson, Colo., has retired after 12 years' active duty. Colonel Gerdes has served as engineer in charge of design for the Bonneville Dam; staff engineer for the Federal Power Commission in Washington D.C., and Atlanta, Ga.; and a principal associate with the Harza Engineering Co., on the Santee-Cooper hydroelectric project. Colonel Gerdes plans to engage in private practice as a consultant in hydraulic engineering.

James P. Growdon, chief hydraulic engineer for the Aluminum Company of America since 1938, is now an engineering consultant on hydraulic engineering problems for the company at Pittsburgh. **B. J. Fletcher,** assistant chief hydraulic engineer, will succeed Mr. Growdon as chief hydraulic engineer.

George M. Haley, formerly with the California State Department of Finance, has accepted the position of director of the Development Division of the Housing Authority of the City of Los Angeles.

Robert F. Herdman, construction engineer for the Bureau of Reclamation at Hardin, Mont., will head a 21-man mission for the Bureau, to Lebanon to engage in a study of potential water resource developments.

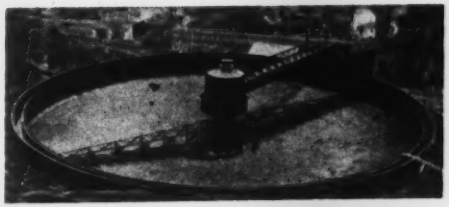
Mark D. Hollis has been promoted from assistant surgeon general to chief engineer of the U.S. Public Health Service in Washington, D.C.

C. F. Horton, formerly manager of transmission and pipe line projects for Brown & Root, Inc., of Houston, Tex., is a newly appointed vice-president of the firm. Mr. Horton has been with the firm since 1935, serving as general engineer in Caracas, Venezuela, and project manager of the Kingsville Air Base, Concho Airfield, and the Naval Air Base at McAlister, Okla.

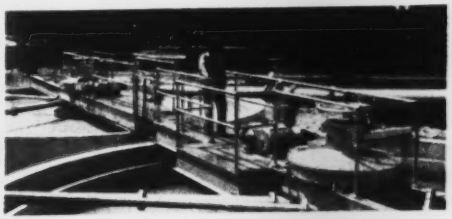
Arthur Reitter has resigned his position as city engineer at Colusa, Calif., to work as a general civil engineer for the Burmese government, on a two-year technical and economic survey.

Frank X. Sandner Jr., of Madison, Wis., was recently recalled to the U.S. Navy and is stationed in Pascagoula, Miss., at the Ingalls Shipbuilding Corp. He is serving in the capacity of resident supervisor of shipbuilding.

Wherever **WASTE WATER** *creates a problem* **HARDINGE CLARIFIERS** *or* **THICKENERS** *can solve it*

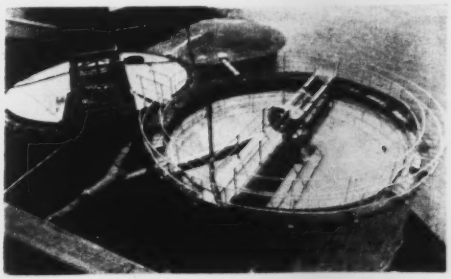


COAL—120' diameter Hardinge Clarifier for removing 60 tons per hour of solids from coal breaker waste water.



LIME—Two 32' diameter by 15' deep Hardinge Thickeners reclaiming calcium carbonate for lime production from clarifier underflow in a water treating plant.

FLUE DUST—A 110' diameter center pier Hardinge Clarifier recovering 50 tons per day of usable solids from blast furnace flue wash water in a steel plant.



PAPER—30' diameter Hardinge Thickener recovering 2 to 2½ lbs. of fiber and filler per 1,000 gallons of paper plant waste water.

Hardinge has installed waste water treating or reclaiming equipment for the following industrial operations:

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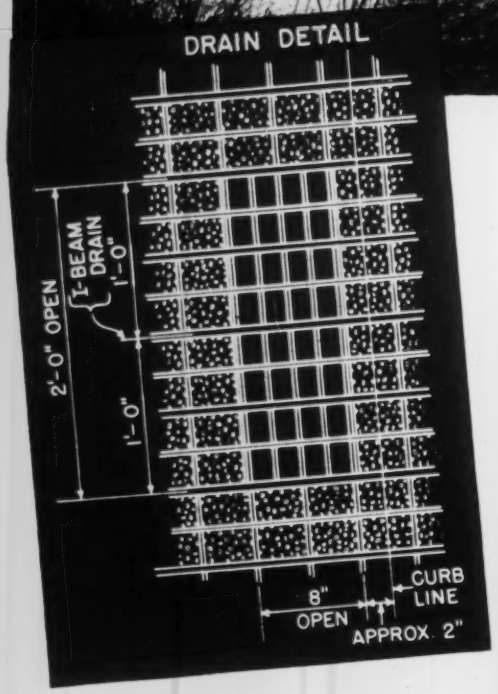
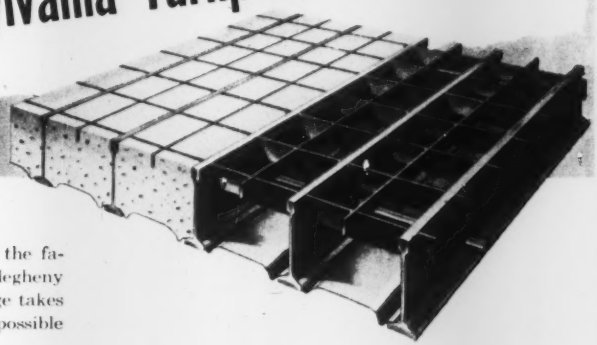


Recently opened to traffic, *this four-lane bridge carries the new Western Extension of the Pennsylvania Turnpike over the Allegheny River. It is floored with concrete-filled U. S. I-Beam-Lok Steel Flooring. The bridge was fabricated and erected by the American Bridge Division of United States Steel Company; concrete was applied by Booth & Flinn, Pittsburgh; designers of the bridge were Modjeski & Masters, Consulting Engineers, Harrisburg, Pennsylvania.*

This photograph shows *the U. S. I-Beam-Lok flooring of the Turnpike bridge before concrete was applied.*

Nearly 4 million pounds of floor deadweight saved

by using concrete-filled U·S·S I-Beam-Lok on new Pennsylvania Turnpike bridge



CARRYING the new Western Extension of the famous Pennsylvania Turnpike over the Allegheny River at Oakmont, this wide, four-lane bridge takes full advantage of the weight savings made possible by U·S·S I-Beam-Lok Steel Flooring.

The bridge consists of five truss spans, arranged in a continuous cantilever pattern, and four girder spans in the north approach. Its 2,179-foot roadway contains 131,669 square feet of $4\frac{1}{4}$-inch I-Beam-Lok. Concreted with $\frac{3}{4}$-inch overfill, it provides a five-inch roadway.

This $4\frac{1}{4}$-inch concrete-filled I-Beam-Lok with $\frac{3}{4}$-inch overfill weighs only 66.5 pounds per square foot. Had eight-inch reinforced concrete floor been used, the weight per square foot would have been 96 pounds. Thus, on the total area of the floor, I-Beam-Lok saved a total of 3,884,235 pounds. And, in addition, important savings in weight and cost were realized in the foundations and supporting members because of the use of this lighter weight floor.

U·S·S I-Beam-Lok also played an important role in the drainage system of the bridge. Unconcreted openings, two feet long and eight inches wide, were left at intervals along the outside of the two 26-foot roadways.

This "modern floor for modern traffic" combines light weight and reduced costs with roadway rigidity, ease of erection, a smooth, hard surface and low maintenance costs. It is available in both concrete-filled and open types. Our engineers will be glad to discuss its possibilities with you.

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William H. Bingham formerly chief, structures and grounds section in the Construction Branch of the Civil Aeronautics Administration, at Atlanta, Ga., announces the opening of an office for general practice in that city at 3982 Peachtree Road N.E.

C. Warren Black, vice-president of the Arundel Corp., Baltimore, Md., has been elected executive vice-president of the corporation, in charge of engineering and construction.

Ralph N. Brescia, lieutenant, CEC, USNR, has been appointed resident officer in charge of construction at the U.S. Naval Hospital, St. Albans, Long Island, N.Y. He was previously assistant resident officer.

Donald S. Hays, associate hydraulic engineer for the Division of Water Resources at Sacramento, Calif., is retiring. He entered the state service in 1922, left in 1926 to join the California Water Service Co., and then returned to the Division of Water Resources where he has served for 15 years.

Serop S. Neresian Associates, consulting engineers, announces that **Arthur E. Hassler,** formerly with the Tidewater Oil Co., is now affiliated with them. The company is moving to new quarters at 398 Main Street, Hackensack, N.J.

W. O. McCluskey, Jr., president of the Consolidated Engineering Co., of Wheeling, W.Va., has been elected president of the West Virginia Society of Professional Engineers. Active in professional and Society affairs, he is a past-president of the West Virginia Section.

John O. Morton, deputy commissioner of Public Works and Highways for New Hampshire, has been promoted to acting commissioner in the absence of **Maj. Gen. Frank D. Merrill,** on active duty with the Army in Washington, D.C.

Theodore Belzner is retiring on March 1, after 52 years of service in the New York City Department of Public Works. For the past 28 years of this period he has been serving as senior inspector of steel construction, bridge inspector in charge of Brooklyn Bridge, and a member of the engineering staff of the East River Bridge.

Theodore Belzner

Aleck P. Ketchen, Bureau of Reclamation Engineer at Columbia Falls, Mont., is joining the staff of Ross Powerhouse Contractors, Rockport, Wash., where he will be in charge of tunnel lining operations at the Seattle City Light Department's Ross Dam. Mr. Ketchen has assisted with survey work on the Boise, Owyhee, Vale, Yakima and Coulee Dam projects, and was in charge of all highway construction in the reservoir area of the Hungry Horse project.

Ivan Sattem, colonel and chief engineer with the N.Y. State Power Authority, New York, has been appointed engineering specialist to the staff of the Remington Rand Laboratory for advanced research at South Norwalk, Conn. A graduate of West Point, Colonel Sattem is also a former associate professor of engineering at the Academy. He joined the State Power Authority in 1947 to superintend planning for the St. Lawrence and Niagara River hydroelectric power projects.

Ivan Sattem

Samuel S. Baxter, president of the Philadelphia Section, assumed the duties on January 7, of Water Commissioner, heading the Philadelphia Water Department. He was formerly chief engineer of the Bureau of Engineering, Surveys and Zoning.

Thomas Buckly, who recently retired from the office of Director of Public Works for the City of Philadelphia, after serving the city for over 40 years, has been retained as consultant on the entire public works program. He has also been named consulting engineer to the Greater Philadelphia South Jersey Council.

Wesley R. Nelson, Assistant Commissioner of the Bureau of Reclamation, Washington, D.C., has transferred to the Department of State to accept an assignment with the Technical Cooperation Administration. Secretary of the Interior **Oscar L. Chapman** presented him with the Department's highest honor, the Distinguished Service Award.

J. C. Stevens and **H. Loren Thompson,** of the firm of Stevens & Koon, announce that **R. E. Koon** has retired from the partnership. **Charles V. Foulds, Frank T. Koehler,** and **Marvin W. Runyan** have been made associates of the firm, which will continue its practice under the name of Stevens & Thompson Engineers with offices at 600 National Building, Portland, Oreg.

L. B. Kuhns, general superintendent of construction for the Aluminum Company of America, Pittsburgh, Pa., has been advanced to the position of chief construction engineer. He has been on the ALCOA staff since 1924. In his new capacity, Mr. Kuhns succeeds **John W. Schrieber,** who is retiring after 42 years.

Conrad H. Lang, assistant district engineer for the State Department of Public Works at Utica, N.Y., has been appointed deputy chief engineer for the New York State Thruway Authority.

Ernest B. Lewey, who had been with the U.S. Coast and Geodetic Survey for 24 years, succeeds **Capt. Charles M. Thomas** as regional representative of the Survey in Atlanta, Ga. Captain Thomas is retiring after 30 years of government service.

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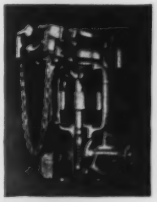

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S. C. Jemian has joined H. A. Kaftan Corp. of Philadelphia, Pa., as chief civil engineer. He was formerly with the Washington District Office of the Corps of Engineers in charge of the Design Section of the Washington Water Supply Division.

John F. Johannsen is retiring as manager of the Hyster Company's export division at Portland, Oreg. Engaged in the export business for the past 20 years, first with the R. G. LeTourneau Company and since 1944 with the Hyster Company, Mr. Johannsen will continue to act as consultant on export problems.

Ralph W. Kluge, former associate professor at Purdue University, has been appointed head of the civil engineering department of the University of Florida, Gainesville, Fla.

Oscar A. Seward, Jr., of Groesbeck, Tex., retired as senior resident engineer of the Texas State Highway Department, after 30 years. During the war he was Director of Supplies and Facilities at the Seattle Port of Embarkation. Mr. Seward is a member of the firm of Seward & Shurtleff, Engineers and Contractors of Fort Worth, Tex.

John R. Snell has been designated head of the department of civil engineering at Michigan State College, East Lansing, Mich. Previously he had been a lecturer on sanitary engineering at Massachusetts Institute of Technology.

I. C. Steele, vice-president of the Pacific Gas and Electric Co., at San Francisco, is retiring after 42 years of continuous service. He joined the company in 1909 after graduating from the University of California at Berkeley and has worked in the capacity of office assistant, assistant engineer and superintendent of building construction, chief of the division of civil engineering, and chief engineer. A past president of the San Francisco Section, Mr. Steele is now ASCE Director from District 11. **Walter Dreyer** has been appointed to succeed him as vice president and chief engineer. He entered the employ of the company as a surveyor, and was promoted to assistant engineer in charge of structural and hydraulic design, then to assistant chief and chief of the civil engineering division.

D. B. Steinman, New York City consultant and bridge authority, has been awarded a French decoration in recognition of his "military engineering services." He is to be made a Knight of the Order of the Cross of Lorraine. Presentation will be made at an early date.

Kenneth Cass Reynolds, professor of civil engineering and head of the general engineering department, University of Southern California, was elected chairman of the University Senate for the academic year 1951–1952.

Charles C. Zollman, formerly with the Preload Corp., of New York, is now chief engineer for the Vacuum Concrete Corp., Inc., Philadelphia, Pa.

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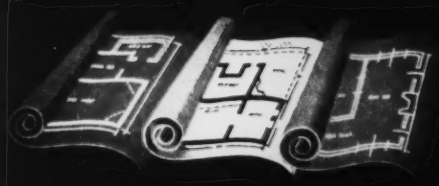

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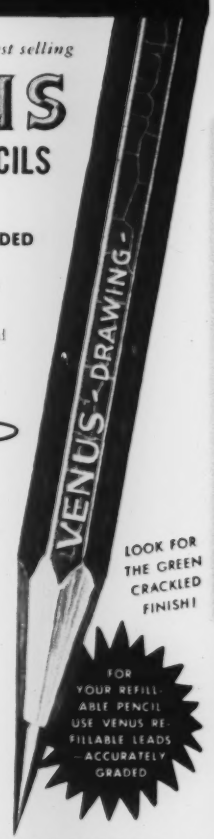

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RECENT BOOKS

ASTM Standards on Bituminous Materials for Highway Construction, Waterproofing, and Roofing

This compilation includes 98 standard and tentative specifications, test methods, recommended practices, and definitions of terms. Additions since the 1948 edition cover methods of testing asphalt base and bituminous emulsions for protective coatings, bitumen content of paving mixtures by centrifuge, various properties of bituminous mixtures, and plastic flow of fine aggregate bituminous mixtures. Several of the earlier specifications and test methods have been revised. (Published by the American Society for Testing Materials, 1916 Race Street, Philadelphia 3, Pa., 330 pp., $4.25.)

Concrete Pipe Handbook

Beginning with a description of the manufacture and testing of concrete pipe, this manual continues with detailed design data for the installation and use of concrete pipe for conduits, sewers, and pipe lines. Extensive structural and hydraulic data are furnished and standard specifications are given. Special aspects such as the jacking of reinforced concrete pipe lines are also considered. (American Concrete Pipe Association, 228 N. La Salle Street, Chicago 1, Ill., 440 pp., $4.)

Manufacturing Processes

Beginning with foundry practice and ending with grinding wheels and abrasives, this volume by Myron L. Begeman presents the technical fundamentals of the important manufacturing processes, discusses engineering materials, and describes the modern machine tools necessary for processing these materials. Inspection and gaging are covered. New material in this third edition includes continuous casting of metals, hydrodynamic forming, plastic molds, special welding techniques, new jigs and fixtures, and various automatic and semiautomatic production machines. (John Wiley and Sons, Inc., New York, 608 pp., $6.)

Mathematics for Engineers

Beginning with algebra and continuing through logarithms, determinants, the slide rule, trigonometric functions, the calculus, and dimensional and similarity analysis, this work (by R. W. Dull and revised and edited by R. Dull) affords a convenient review of those phases of mathematics which are especially important in engineering work. It is intended either for use as a practical reference work or as a text for private study. A chapter on differential equations has been added, and other revisions have been made to bring the book up to date. (McGraw-Hill Book Co., New York, Toronto, London, 1951, 822 pages, $7.50.)

National Research Council, Highway Research Board, Proceedings of the Thirtieth Annual Meeting, Washington, D.C., January 9–12, 1951.

Edited by R. W. Crum and Associates, the forty-six papers printed in this current volume are divided into the following major subject groups: Economics, finance, and administration; design details, covering pavements, bridges, and other structures; materials and construction, including tests; maintenance; traffic and operations; and soils and soil mechanics. The volume also contains lists of papers and reports released in other publications of the Board. (National Research Council, Highway Research Board, 2101 Constitution Avenue, Washington, D.C., 1951, 532 pages, $7.50.)

Handbuch des Wasserbaues, Band I

This classic work, by A. Schoklitsch, the first edition of which was translated into English, is now being revised after some twenty years. Volume I covers as before the following subject matter: Introductory meteorology; hydrology and hydraulics, with special attention to water supply; water-supply engineering in all its aspects; sewerage and sewage disposal and treatment. The short chapters on soils and soil mechanics and on structural materials have been omitted. Detailed drawings, graphs and illustrations are included for all topics covered, and a bibliography of publications consulted accompanies each section. (Springer-Verlag, Vienna, Austria, 1950, 475 pages, $13.50, D.M. 56, £4 16s.)

Materials Handling. Principles, Equipment and Methods

The fundamental principles involved in the economical handling of those materials not handled in bulk, and the equipment and methods used, are described and explained in this work (2nd edition) by Harry E. Stocker. A large amount of information about trucks, tractors, conveyors, cranes, and other equipment is provided, with many illustrations. The main revision has occurred in the chapters on conveyors, the selection of equipment, and building design as related to materials handling. (Prentice Hall, Inc., 70 Fifth Avenue, New York 11, N.Y., 330 pp., $5.)

Data Book for Civil Engineers. Vol. I: Design; Vol. II: Specifications and Costs

Volume I of this work by Elwyn E. Seelye presents a concentrated collection of effective data necessary for design procedures in the main fields of civil engineering: structures, sanitation, water supply, drainage, roads, airfields, dams, docks, bridges, and soils. The object is to provide a single reference volume for the engineer whose work may spread into fields outside his specialty. Modern codes, practices, and designs are emphasized. Volume II provides data necessary to prepare specifications for airports, roads, railroads, bridges, dams, docks, drainage, and sewers. Swimming pools and athletic fields are briefly considered. Relative cost analyses are included for each type of work, and there is a classified glossary of terms. (John Wiley and Sons, Inc., 440 Fourth Avenue, New York 16, N.Y., Vol. I, $10; Vol. II, $13.)

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New Publications

Sanitary Engineering. Studies of the physical qualities of various materials used in joining vitrified clay pipes, with a determination of the composition of joint compounds that should give satisfactory service, comprise Sanitary Engineering Series No. 3 issued by the University of Illinois. The tests were made possible through funds provided by the Clay Products Association, which cooperated with the Engineering Experiment Station in the conduct of the work. Entitled *Joint Materials for Vitrified Clay Pipes*, the report was written by Harold E. Babbitt, M. ASCE, professor of sanitary engineering. Inquiries should be addressed to the Department of Civil Engineering, University of Illinois, Urbana, Ill.

Atmosphere Pollution. Availability of a new four-page folder, entitled *The Development of Prototype Model Research on Atmosphere Pollution Problems*, is announced by the Bureau of Public Information of the New York University College of Engineering, New York 53, N.Y. Text material was prepared by Associate Professors William T. Ingram, A.M. ASCE, and Gordon H. Strom. The cost is 10 cents.

Slag Block. Information pertaining to the properties of slag and slag-concrete masonry units that would be helpful to architects, engineers and block manufacturers is set forth in a recent manual made available by the National Slag Association. Copies are obtainable from the headquarters of the Association, 644 Warner Building, Washington 4, D.C.

Road Conference. Highway problems at all levels are considered in the *Proceedings* of the Third California Conference on Street and Highway Problems, recently published by the Institute of Transportation and Traffic Engineering at the University of California. Two of the 34 papers comprising the volume deal in detail with important aspects of national defense. The illustrated, paper-bound copies are available from the University Press, University of California, Berkeley 4, Calif., at $1 each.

Steel Products. Continuing its revision of the Steel Products Manual, which is being issued in sections, the American Iron and Steel Institute announces the availability of Sections 18 and 20 covering *Steel Tabular Products* and *Wrought Steel Wheels*, respectively. Copies may be obtained from the Institute, 350 Fifth Avenue, New York 1, N.Y., for 25 cents apiece.

Waste Disposal. Proceedings of the Sixth Industrial Waste Conference—sponsored by Purdue University and the Indiana State Board of Health at Purdue in February 1951—have been issued as Engineering Extension Department Series No. 76. Inquires concerning the 524-page publication should be addressed to the University Editor, Purdue University, Lafayette, Ind.

Environmental Health. In a 152-page volume, entitled *Environment and Health*, the U. S. Public Health Service has assembled its first work dealing comprehensively with environmental health. The volume describes the problems that exist in the field and the efforts being made to solve them. Copies are for sale by the Superintendent of Documents, Government Printing Office, Washington 25, D.C., at 75 cents each.

Highway Engineering. The Proceedings of the 1951 Ohio Highway Engineering Conference, held at Ohio State University in April 1951, have been issued as Engineering Experiment Station Bulletin No. 145. Copies of the 173-page publication, which is priced at $1, may be purchased from the Director of the Station, Ohio State University, Columbus, Ohio.

Welding Design. To keep pace with the demand for its Manual of *Welding Design and Engineering*, the Eutectic Welding Alloys Corporation has released a fourth edition of the work. Enlarged to 72 pages, the new edition contains many photographs and drawings together with latest data and how-to-do-it articles. Copies are available without charge from the Eutectic Welding Alloys Corporation, Dept. "P," 172nd Street and Northern Boulevard, Flushing, N.Y.

Irrigation Outlets. Comprehensive information relating to the design and construction of irrigation outlets, originally presented for discussion to the Punjab Engineering Congress in 1944, has now been assembled in book form by the authors—N. H. Gulhati, chief of the Natural Resources Division, Planning Commission, Government of India, and secretary general of the International Commission on Irrigation and Drainage, and S. I. Mahbub, of the Public Works Department, Punjab Irrigation Department. One of the few publications on the subject of irrigation outlets, the book is priced at Rs 12/8. The publishers and booksellers are Atma Ram & Sons, Kashmere Gate, Delhi, India.

Concrete Construction. Investigations designed to develop data on the suitability of Prepakt concrete for new construction work, conducted as part of the Civil Works Investigations Program of the Office of the Chief of Engineers, are reported as Technical Memorandum No. 6-330 of the Waterways Experiment Station. The studies indicated that mass concrete having a high strength and adequate durability can be made by the Prepakt method with a portland cement content of less than 2 bags per cu yd, and that reinforced concrete of good quality can be made by this method with the cement factor of approximately 4 bags per cu yd. Copies of the memorandum, priced at $1 each, may be obtained from the Waterways Experiment Station, Vicksburg, Miss.

American Standards. Results of a survey undertaken by the American Standards Association for the Economic Cooperation Administration as a means of implementing productivity in Marshall Plan countries have been made available in an interesting and timely brochure entitled *Dollar Savings Through Standards*. Copies, priced at $1 each, may be obtained from the ASA, 70 East 45th Street, New York 17, N.Y.

Traffic Studies. A paper on highway traffic studies summarizing the work that has been done in studying the characteristics of vehicular flow, and an annotated bibliography covering traffic volume studies, origin-destination surveys, and various aspects of highway planning, comprise a 277-page publication of the Highway Research Board. Identified as Bibliography No. 11, the compilation is entitled *Origin Destination Surveys and Traffic Volume Studies*. Copies may be purchased for $3 each from the Highway Research Board, 2101 Constitution Avenue, Washington 25, D.C.

Refresher Course, Review. In the book note in the December 1951 issue (p. 92) on S. W. Spielvogel's *Review of Structural Design for Professional Engineers License Examinations*, 1951 revision, it was erroneously noted that the McGraw-Hill Book Co. is the publisher. Copies are available only through the author at 15 Old Field Lane, Lake Success, N.Y. The price is $4, postpaid.

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Men Available

CIVIL ENGINEER J. M. ASCE, member Tau Beta Pi, 27, single, recalled by United States Air Force as first lieutenant September 1950, due to be released June 1952. Over 1,000 hours flying time as navigator. 600 of these as instructor. Desires position in engineering sales. Prefers position in which Air Force background may be utilized. C 719

CIVIL ENGINEER M. ASCE, registered, 47, experienced in structural design of powerhouses, dams, ports, industrial buildings, canal structures and weirs. Have made complete river basin surveys, structural plans, specifications and engineering reports. 21 years U. S. and foreign experience. Available immediately. C 720

CIVIL ENGINEER A. M. ASCE, 43, married, registered professional engineer and land surveyor. BS. in E. from University of Washington, some graduate study. Twenty years extensive engineering experience on canals, dams, pipe lines, highways, sewers, water systems and railroads. Location preferred United States. C 721 (2) A-3 San Francisco

CIVIL ENGINEER with legal degree. J. M. ASCE, 26, married, veteran. BS. January 1948, U. of R. June 1952, one year's experience in bridge design, 4 months with Highway Planning Department. C 722 Chicago

ENGINEERING GEOLOGIST A. M. ASCE, 44, married. BS. in geology degree. 17 years experience in heavy construction exploration, planning, foundation treatment and design. Capable of taking complete charge of exploration and geologic investigations. C 723

Positions Available

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ENGINEERS. (a) Civil or Mining Engineer, not a graduate with some experience in road building and construction for field work. Knowledge of Spanish essential. Location Caribbean area. (b) Junior Mining, Civil or Mechanical Engineer with mining and construction equipment experience to assist in office engineering covering correspondence, requisitions, specifications, layouts, etc. Salary $4,000-$5,200 a year. Location New York, N. Y. Y 6000

QUALIFIED CIVIL ENGINEER to 30 to obtain key sales position with old, well established construction machinery manufacturer. Introduces open-in-central and Western states. Splendid opportunity for advancement. Apply by letter giving age, experience, salary expected, business and character references. Headquarters, Ohio. Y 6088

CONSTRUCTION SUPERINTENDENT to take complete charge of field construction work for large concrete gravity dam. Salary open. Furnished living quarters provided. Family can accompany successful candidate. Location India. Y 6091

SANITARY ENGINEER young with 1 to 8 years experience handling waste disposal problems in industry or with municipal background. Salary $4,200-$5,400 a year. Location Pennsylvania. Y 6089

SANITARY ENGINEERS. (a) 40, to design and draw up sewage systems and treating plants, etc. with knowledge of water production and distribution. Should have about 10 years practical experience in addition to a degree in sanitary engineering. Location Virginia. Y 6120

CONSTRUCTION FIELD SUPERINTENDENT, experienced in all phases of heavy industrial construction, to direct work on major construction projects. Will supervise division engineers. Location Delaware. Y 6193

ENGINEERS. (b) Sales Engineers with engineering degrees, young, with experience with a state highway commission helpful. Company fabricates and distributes to the highway and drainage fields, such products as corrugated culvert, welded pipe, etc. (c) Civil, mechanical or electrical engineer preferred, to start as sales correspondent or as a product development engineer and eventually work into the field of sales. Some traveling involved later on. Must be citizens of U.S.A. Salary $3,600-$4,800 a year. Location Ohio. (d) Sales Engineer, young, preferably single, civil graduate, for foreign sales work after two years training period in this country. French or Spanish helpful. Y 6203

ASSISTANT OR ASSOCIATE PROFESSOR OF CIVIL ENGINEERING, 35-50, with advanced degree and some teaching experience. Should be qualified in fields of soil mechanics and highway engineering. Salary about $4,000-$4,700 a year. Location New England. Y 6228 (6)

STRUCTURAL DESIGNERS, civil engineering degree with 2 to 10 years experience on structural design work including new projects, buildings, roadways, paving, etc. Combination of field and office necessary. Must be able to submit tenderings, etc. Salary $4,800-$7,500 a year. Location New York, N. Y. Y 16230 (6)

DESIGNERS with some experience in structural design, sanitary, water supply, architecture, plumbing and heating, and electrical work, for engineering organization. Salary plus bonus. Location Illinois. Y 6240

PROJECT ENGINEER, civil and architectural, with experience in office and institutional type buildings. Considerable traveling. Salary $7,500 a year. Headquarters, Washington, D.C. Y 6359

RESIDENT ENGINEER, civil graduate, with general construction experience preferably on airfields and the development of airbases. Salary, $6,000 a year. Location North Africa. Y 6395

ENGINEERS. (a) Hydraulic and Structural Engineer, civil graduate with at least 8 years hydroelectric experience to design and supervise design of dams, canals, penstocks and associated hydraulic works. Design foundations for various types of structures, including buildings. Make extensive and important studies involving various hydraulic problems in connection with power system development, prepare estimates and reports, direct preparation of plans and supervise construction operation. Salary $6,000-$7,200 a year. (b) Assistant Engineer, hydraulic and structural, civil graduate with at least 4 years hydroelectric experience to lay out and prepare plans, make investigations in connection with various hydraulic and structural problems for system development and expansion. To take charge of general supervision of a survey party or group of draftsmen. Make and check estimates of quantity and costs. Prepare reports. Salary $4,500-$5,100 a year. Location New England. Y 6415

HYDRAULIC ENGINEERS for work including the collection, computation and tabulation of hydrologic, hydraulic and engineering data for water supply and flood control work. (a) Junior Hydraulic Engineer, graduate. Salary $4,000-$4,600 a year. (b) Assistant Hydraulic Engineer or Senior Hydraulic Engineer, graduates. Assistant Engineer should have some experience in collecting engineering data and performing hydraulic and related engineering work. Salary $4,480-$4,480 a year. Senior Engineer should have three years experience in hydraulic engineering, including problems in hydraulics and design of hydraulic structures, experience in hydraulic lab testing of models desirable, writing of technical reports on related work. Salary $4,480-$5,280 a year. Must be resident of New Jersey. Y 6546

ASSISTANT SUPERINTENDENT, civil, electrical, mechanical or industrial engineer, need not be graduate engineer, but should have a working engineering knowledge, to take charge of all personnel and direct the assistant foremen in charge of various mechanical trades to get necessary work done on the buildings and grounds of a college. Salary $4,500-$5,500 a year to start. Location, New England. Y 6568

CIVIL ENGINEER, under 40, with at least 10 years industrial building construction and plant engineering experience, to supervise plant expansion, equipment installation, etc. Salary open. Location, Liberia. Y 6586

CIVIL ENGINEER with at least 10 years' chemical construction experience, to supervise field and office jobs. Salary, $6,000-$10,200 a year. Location, New York. Y 6591 (6)

CIVIL ENGINEERS for drafting, designing and the detailing for utilities and structures. In the field the work will consist of inspection and testing, estimate computations, establishment of line and grade and related field duties. Location, Maryland. Y 6595 (4)

ENGINEERS. (a) Water works engineer, senior, experienced in operation, management and construction of water utility plants, to direct hydraulic studies and design for improvements, as well as direct supervision of operation. (b) Junior Engineer, recent civil graduate, interested in water works utility plant. Salaries open. Location, New York State. Y 6604

CIVIL ENGINEER experienced in water supply and/or dam design studies and reports. Location Pennsylvania. Y 6607

FIELD INSTALLATION ENGINEER, civil or mechanical training with tunneling and heavy construction experience for sales, service and installation of tunnel lining materials. Salary open. Location, Midwest. Y 6612

CIVIL ENGINEERS. (a) Civil Engineer, graduate with 3 years experience in drafting and design of structural details of any equivalent combination of education and experience with a maximum substitution of 2 years experience for 2 years of college unless a registered professional engineer. Salary, $4,576-$5,460 a year. (b) Civil Engineer, graduate with 5 years experience in design of structures or certificate as registered engineer and 5 years of such experience. Salary $4,992-$5,980 a year. Location, Virginia. Y 6624

CIVIL ENGINEER, graduate, with at least 8 years design and field experience on waterfront construction, pump house, office building, tank foundations, to design bulk terminals with occasional field inspection work. Salary, $6,000-$8,000 a year. Location, New York, N.Y. Y 6647

CONSTRUCTION SUPERINTENDENT, civil graduate, 35-45, with at least 5 years field engineering and supervisory building construction experience to take charge of housing projects, hospitals, etc. for general contractor. Salary, $6,000-$9,000 a year. Location, Panama and Caribbean area. Y 6655

STRUCTURAL ENGINEER graduate, B.S. in C.E., 25-40, with construction experience in drafting and design work. Must be willing to work on the board as design engineer in the design of steel and concrete structures and foundations. Position will possibly lead to that of Construction Engineer. Salary, $4,200-$6,000 a year. Location, Cuba. Y 6658

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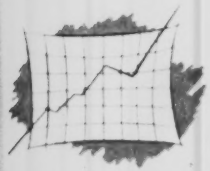

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Non-ASCE Meetings

Society for Experimental Stress Analysis. The spring meeting of the Society for Experimental Stress Analysis will be held in Indianapolis, Ind., May 14-16. The technical sessions will be held under the direction of Prof. J. M. MacLean of Rose Polytechnic Institute at the Lincoln Hotel in Indianapolis.

American Society of Mechanical Engineers. The spring meeting of ASME will take place March 24-26, on the campus of the University of Washington, Seattle, Wash.

National Association of Power Engineers. The Hotel Sherman, Chicago, Ill., will be the headquarters of the national meeting of the National Association of Power Engineers, to take place on March 23.

Naval Conference on Airfield Pavements for Jet Aircraft. To encourage exchange of information on research in the field of design or modernization of airfield pavements to withstand the effects of jet-powered aircraft, the U. S. Naval Civil Engineering Research and Evaluation Laboratory is sponsoring a symposium on the subject, to be held in Port Hueneme, Calif., April 17-18.

New York State Association of Highway Engineers. Headquarters for the 13th Annual Convention of the New York State Association of Highway Engineers will be the Hotel New Yorker, New York, N.Y., March 19-21. Harry Spitzer, Box 38, State Office Building, Babylon, L.I., New York, is the convention secretary.

Georgia Highway Conference. The first annual meeting of the Georgia Highway Conference will be held at the Georgia Institute of Technology, in Atlanta, Ga., April 2-4. It will be sponsored jointly by the Georgia State Highway Department and the Georgia Tech School of Civil Engineering and Engineering Extension Division.

Structural Conference. A conference for structural engineers in the Texas area, covering both structural steel and reinforced concrete, will be held on the campus of the University of Texas, at Austin, Tex., March 21 and 22.

Positions Announced

Corps of Engineers. The New York District Engineers announces availability of positions as Civil Engineer to prepare specifications and estimates; Civil Engineer interested in pavements; Hydraulic Engineer for hydrologic studies; and Hydraulic Engineer for power investigations. Further information regarding these positions may be obtained by communicating, in person or by telephone (Worth 4-7300, extension 560) with the Personnel Branch, 4th floor, 80 Lafayette St., New York, N.Y.

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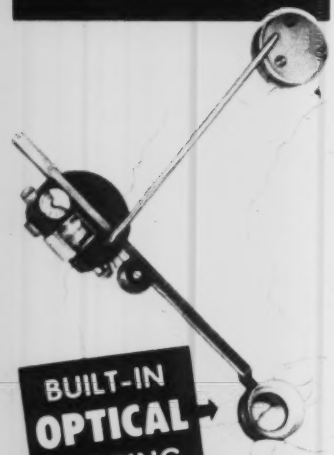

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Veterans Administration. Openings for engineers with sanitary, construction and structural experience are available with the Veterans Administration in Washington, D.C. The salary ranges from $3,410 for a graduate with no experience, to $5,940 for 2 years' experience. For full information apply to Departmental Personnel Office, Veterans Administration, Washington 25, D.C.

State of Illinois, Division of Waterways. Announcement is made of open positions for Civil Engineers and Topographic Draftsmen for investigation and planning of flood and low flow control, shore erosion, and related projects. Some experience or training in hydraulics or hydrology desirable, but not essential. Address inquiries to State of Illinois, Division of Waterways, 201 West Monroe St., Springfield, Ill.

Buffalo District, Corps of Engineers. Professional Engineers, Engineering Aides, Surveymen, and Construction Superintendents, are now being recruited for duty in Alaska, at salaries ranging from $3,410 to $5,940. The government will pay transportation expenses of selected employees, who complete a two-year contract. Address inquiries to the Office of the District Engineer, Buffalo District, Corps of Engineers, Foot of Bridge St., Buffalo 7, N.Y.

Solution to problem on page 35

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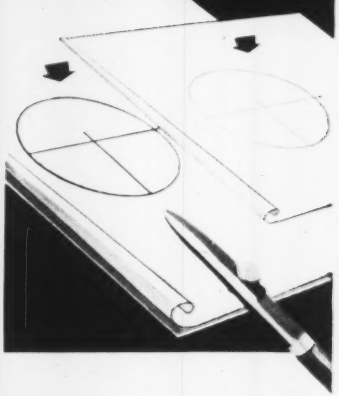

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John Isadore Cahalan, Jr., Wilmington, Del.
Enos James Carlson, Denver, Colo.
Rodney Vance Colvin, Everett, Wash.
John William Cuddy, Washington, D.C.
Clarkson Lee Holmes, Los Angeles, Calif.
Erik Peter Johnson, New York, N.Y.
Ghulam Hassan Khan, Kashmir State, India
John Richard Kinney, Kansas City, Mo.
William Ross Moore, Casablanca, Morocco
David Erwin Morris, Tacoma, Wash.
Gerner Artander Olsen, New York, N.Y.
Edwin George Ossess, Billings, Mont.
Raymond Charles Postels, Superior, Wis.
Luther Ryan Ringo, La Grange, Ky.
Carol Casterman Smith, Decatur, Ala.
Asbjary Le Allen Spencer, Chicago, Ill.
John Burke Walsh, New York, N.Y.
Althonse Anderson Winter, Dothan, Ala.

Applying for Associate Member

Joseph Denny Bonness, Jr., Milwaukee, Wis.
Kenneth Sharrock Cleaves, Fairfield, Me.
Phillip Daniel Comstock, Louisville, Ky.
Robert Von Kleist Duey, Richmond, Va.
Noel James Everard, New Orleans, La.
Vasudeo Nagesh Gunaji, Madison, Wis.
Roscoe Baldwin Hatch, Bonneville, Oreg.
Joe A. Hicks, Jr., Houston, Tex.
John Henry Klinck, Jr., Jacksonville, Fla.
Robert Rufus Kuhlow, Louisville, Ky.
Clarence Philip Mathew, Madras, India
Edward Winborn Mellichampe, Jr., Denver, Colo.
Edwin Nashburg, Ephrata, Wash.
John Joseph Reilly, New York, N.Y.
Richard Henry Reuter, Anchorage, Alaska
William Schueller, Toledo, Ohio
John James Skelly, Martinsburg, W.Va.
Ray Hamilton Skelton, Hyattsville, Md.
Junius Winfield Stephenson, III, New York
Angelo Tabita, Jacksonville, Fla.
A. Reussel Tryon, Buffalo, N.Y.
Reynold King Watkins, Logan, Utah
Paul Wildmore, Washington, D.C.

Applying for Junior Member

Arthur William Anderson, Jr., Walnut Creek, Calif.
Jesus Barbero, Panama, Canal Zone
Louis Nelson Barfield, Jr., Vicksburg, Miss.
Frank Anthony Beuse, New York, N.Y.
Richard Charles Byce, Jr., Ann Arbor, Mich.
Juan Ipalare Danghi, Stanford Univ., Calif.
James Tucker Emanuel, Glendale, Calif.
Robert Richard Fatih, Phoenix, Ariz.
James Hopkins Gifford, San Francisco, Calif.
Earl Penilton Gilmore, Victorville, Calif.
William Michael Haas, Pittsburgh, Pa.
Charles Edward Haley, Phoenix, Ariz.
Wesley Boyd Hamilton, Charleston, S.C.
Howard Leo Heines, Milwaukee, Wis.
Donald Henry Herak, Spokane, Wash.
John Shattuck Hutchins, Los Angeles, Calif.
Edward Martin Jolly, Shreveport, La.
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Alfred Eugene Knapp, Wichita, Kans.
Felix Kulka, Burbank, Calif.
Earl Erwin Kurp, Augusta, Ga.
Donald Edward LeBeau, Wilmington, Del.
Richard James Lynch, East Orange, N.J.
Paul Joseph Marzullo, Haddonfield, N.J.
Robert George Mathey, Cocoa, Fla.
John Charles Nacos, Pasadena, Calif.
Robert Michael O'Shea, Toledo, Ohio
Emmett William Pacetti, St. Augustine, Fla.
Rufus Richard Robinson, Jr., Kansas City, Mo.
James Gordon Sutherland, Champaign, Ill.
Trenton Earl Toland, Prichard, Ala.
Allen Joseph Wright, Silver Spring, Md.
John Anthony Zapple, Omaha, Nebr.

[Applications for Junior membership from ASCE Student Chapters are not listed.]

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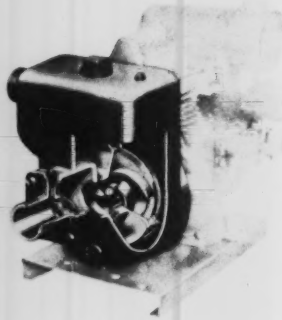
EQUIPMENT, MATERIALS and METHODS

NEW DEVELOPMENTS OF INTEREST AS REPORTED BY MANUFACTURERS

Pumps

A COMPLETE LINE of contractor's pumps has been introduced. The pumps, self priming centrifugals, have been entirely redesigned and bear no outside resemblance to former models. Construction is much simpler than previous models. The pump is made up of a check valve assembly, a tank, a diffuser, an impeller, and a shaft seal. The check valve is conveniently mounted on the outside of the pump. It forms an accessible porthole reaching directly to the pump impeller. The tank is cast in one piece and may be removed by loosening only one circle of bolts. This exposes the working interior parts of the pump. The diffuser is held in place by the tank and can be lifted off the impeller when the tank is removed. It is only necessary to loosen one cap nut to remove the impeller. These five simple assemblies form the basic structure of the pump. Only two parts, the impeller and diffuser, can wear and reduce the efficiency of the pump. Both are easily replaced, restoring original factory efficiency. The pumps can be quickly put into operation. Both suction and discharge connections are male threaded and hose connections are made directly to the pump. It is not necessary for the user to furnish extra fittings. When the hose is connected, the pump tank is filled with water through a large opening in the top of the tank. Once the pump tank is filled, priming and repriming operations are entirely automatic. Operation is exceedingly simple. It is only necessary to start the engine to start pumping. Marlow contractors pumps are available up to 240,000 gph. **Marlow Pumps, Box 566, Ridgewood, N. J.**



Self-Priming Centrifugals

Altimeter

THE FA-1SI SENSITIVE altimeter has been designed particularly to withstand the severest service in the field. For durability, the altimeter mechanism is supported by a shock mounting in a sturdy aluminum case with a latched metal lid. The instrument case contains a desiccant to absorb moisture and the instrument may be completely sealed to protect it during transport. The altimeter employs the W&T mechanism featuring the self-balancing principle and custom calibration. **Wallace & Tiernan Products, Inc., 1 Main St., Belleville 9, N.J.**

Roller

THE GARDNER ROLL consists of two sections mounted on roller bearings and free to rotate independently on the guide roll axle. Heavy, metal islands are mounted on sturdy spokes and form the compacting surface of the roll. Design of the roll enables the guide roll and the drive roll to compact loose materials at much higher unit pressures than obtainable with the conventional smoothfaced roll. The pads enter the loose material with a minimum of displacement, thus eliminating undesirable flow of the material. The pads leave the material layer without disturbing the compacted material, thus the roll uniformly compacts the material layer throughout the entire depth, and subsequent treatment and rolling of uncompacted top layers of material is not necessary. The Gardner roll produces greater and more uniform densities in less rolling time in the compaction of loose materials in fills, stabilized bases and cold and hot mix wearing surfaces. The roll is interchangeable with the smooth-faced guide roll on Buffalo-Springfield KT-19, KT-20, KT-24B and Kt-25B tandem rollers. **The Buffalo-Springfield Roller Company, Springfield, Ohio.**

Special Compacting Design

Fork Lift Attachment

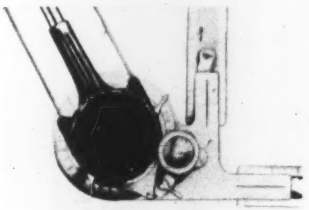
DEVELOPMENT OF A 5 ft power driven fork lift attachment for the versatile Moto-Bug has been announced. The materials handling device has a capacity rating of 1000 lbs at 15 in. load center. In addition, it can climb a 12 percent grade with full load and has a 61 in. turning radius. Designed to answer special handling problems in shipping centers, industrial plants and in many phases of construction work, the 5 ft fork lift unit operates from a power driven hydraulic pump. For effortless maneuvering, operator rides on rear step, has full power forward and reverse. A large steering wheel is connected directly to the dual rear wheel through a 3.6 to 1 gear reduction. Moto-Bug's 33 in. width easily clears narrow aisles and doorways. Standard forks are 20 in. long and adjust to any required width up to maximum 33 in. Equipped with a standard make 6 hp gasoline engine, power is transmitted by V-belt and roller chain through an automotive type differential in the front axle for reliable 2-wheel drive. Because the complete unit weighs only 1500 lbs, the fork lift Moto-Bug can work with safety over old floors, in elevators and air cargo planes, or on light ramps. With 75 percent of loaded weight on front drive tires, good traction is guaranteed. Dual drive wheels are available as optional equipment. The fork lift unit is easily interchanged with other front end attachments to make the Moto-Bug an all-purpose performer wherever materials are loaded, lifted or moved. Alternate attachments include: a 1500 lb capacity flatbed platform, a 10 cu ft capacity hopper body or a 5 ft scraper blade. **Kwik-Mix Company, a subsidiary of the Koehring Company, Port Washington, Wis.**

Moto-Bug Unit

Equipment, Materials & Methods (Continued)

Drafting Machine

THE CIVIL ENGINEER'S machine is highly specialized for extreme accuracy in making maps. The protractor is divided to $\frac{1}{2}$ deg; a double vernier reads to 1 minute; two rows of figures—one by quadrants, one from 0 to 360 deg. A micrometer screw and a magnifying glass make possible extremely accurate settings of



Specialized for Map Making

angles. The entire micrometer mechanism, including the master gear, is fully enclosed to keep out dirt and insure smooth action. This machine repeats on the drafting table the operations of a transit in the field, the edge of the scale taking the place of the line of collimation of the telescope. This enables the engineer to plot directly from field notes any type of surveying data, including traverses or side shots by deflection angles, bearings, or azimuths; also, preliminary lay-outs for triangulation nets. The upper motion of a transit is represented in this instrument by the motion of scale arm around the protractor. The lower motion is represented by the motion of the protractor circle relative to the pulley. An additional motion, having no equivalent in the transit, is provided by a lock which clamps the baseplate directly to the pulley and leaves the protractor free to be rotated by the micrometer screw. This gives additional flexibility in operation. **V. & E. Manufacturing Co., Pasadena, Calif.**

Computing Service

DUE TO THE INCREASING importance of mathematical methods in the field of civil engineering, a group devoted exclusively to applied mathematics has been organized. The service specializes in performing services for industries and universities desiring engineering calculations of a high degree of complexity and the treatment of related mathematical problems in the field of civil engineering. An important function of the group is the mathematical formulation and complete solution of a problem from given physical data. The staff consists of consultants holding Doctorate Degrees who are qualified to treat problems in applied mathematics related to civil engineering. **Mathematical Computing Service, 105 Court St., Rm. 604, Brooklyn 2, N. Y.**

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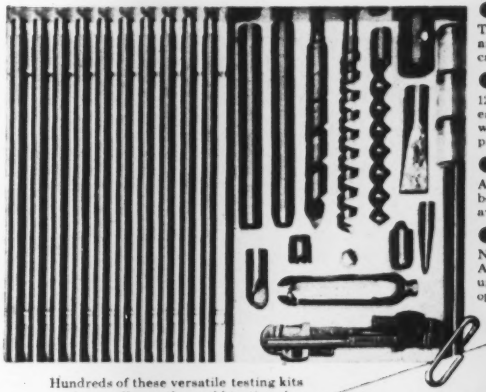

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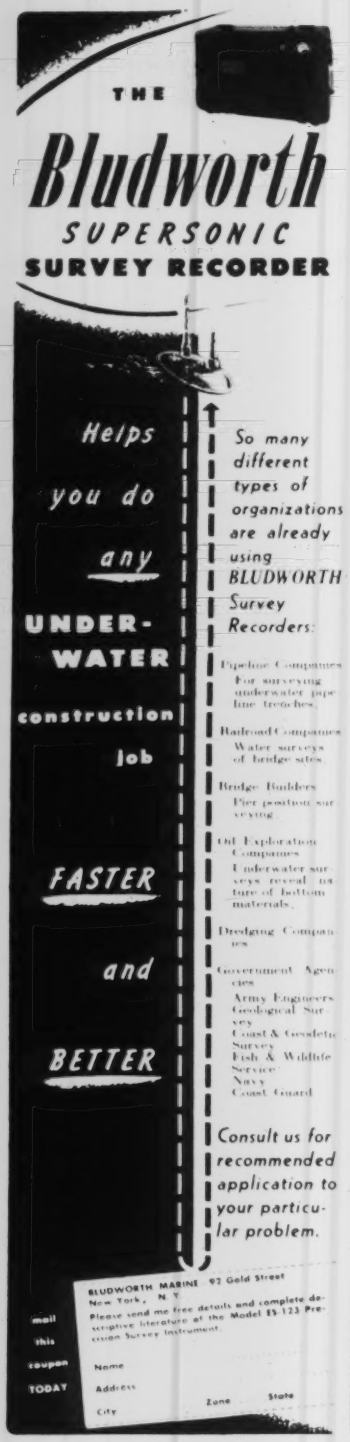

Equipment, Materials & Methods (Continued)

Power-Tool!

WEIGHING LESS than 5 lbs, the Velocity power tool can drive a stud through wood or metal into concrete so that it will resist a pull of several thousands of pounds. Tests conducted at a project showed that studs embedded in the ceiling firmly held a dead weight of 1400 lbs. Each stud used in the Velocity power tool is attached to the blank cartridge by a metal piston which directs the stud accurately into the work and prevents it from ricocheting should it strike a reinforcing rod. The piston arrangement prevents any error in selecting combinations of studs and cartridges for different types of work. To operate the tool, a safety lever in the handle must be rotated 180 deg so the firing pin is moved within range of the cartridge primer. Unless the safety arm is rotated, the firing pin cannot contact the primer. This safeguards against accidental discharge if the tool is dropped. When the tool is pushed against the material to be penetrated, the spring loaded firing pin is actuated and strikes the cartridge primer. The ensuing discharge drives the stud. **Velocity-Power Tool Co., Pittsburgh, Pa.**

Clamshell

SHAFT SINKING OPERATIONS on tunnel or mine projects no longer need to be slow and expensive. Reducing the need for fine fragmentation, cutting strenuous hand shoveling up to 90 percent and reducing preparation time necessary to start mucking operations are a few of the advantages of the Hydromucker. The recently improved hydraulically operated ¾ yd clamshell makes mucking fast and simple. The heavy duty 1,630 lb bucket with alloy steel lips and teeth provides the resistance to wear necessary for real hard rock digging. In normal operation, the bucket scoops up a load and dumps it on a tray which is placed near the digging operation. When the tray is filled, the hoist operated lift rope is removed from the Hydromucker bucket and attached to the loaded tray which is then dumped into a skip or car and hoisted to the surface. On one job, cuts for blasting were deepened from 7 ft to 9 ft and output was increased 35 percent using the Hydromucker and less hand labor than was previously needed. The hydraulic action supplied by two 6 cylinder axial style piston pumps, each delivering pressures of 3500 psi and providing ample closing pressure at the teeth, causes the bucket to bite them into muck rather than draw away during closing like rope reeved buckets. There is no vertical line pull during digging. The sturdy, compact power unit is skid mounted and equipped with a lifting eye for easy handling. The 15 hp splash proof motor is equipped with a rain tight starting switch. Power to pumps is transferred through adjustable V belts. **Bucyrus-Erie Company, South Milwaukee, Wis.**

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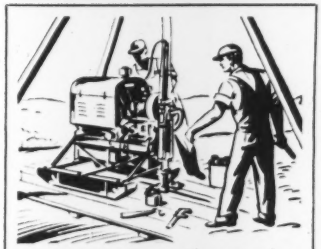

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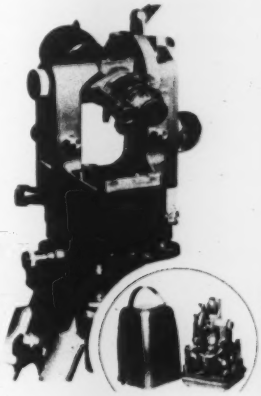
Equipment, Materials & Methods (Continued)

Surveying Transit

THE E. S. 4150 R Optical Theodolite-Transit is a 6 sec glass circle instrument specially designed to meet the needs of engineers and surveyors. The transit incorporates numerous advances in design which make instrument operation more rapid, more precise, and less fatiguing. Its compact design permits all operations, from the first levelling to the final reading



The 4150 R

of angles, to be controlled from the operator's position behind the instrument. There is no plumb bob on the 4150 R. Instead there is the optical plummet which works in periscope fashion: looking into the plummet, the operator sees the plummet reticle circle whose center is the exact projection of the instrument axis upon the ground point. Precise centering is possible in less time without the annoyance of plumb bob swing due to wind or vibrations. The optical reading system eliminated reading glasses, verniers, and parallax errors. Both horizontal and vertical angles are read at a glance to 6 sec by simply viewing into the microscope eyepiece next to the telescope. The repeating lever is a unique feature of the 4150 R which speeds and facilitates the repetition of angles. Errors and confusion in performing repeats are eliminated. The instrument weighs less than 10 lbs, and is provided with a lightweight, compact alloy carrying case which holds the 4150 R suspended in three rubber buffers, insuring against damage by shock or vibration. **Trans-Global Company, 1480 Broadway, New York 18, N. Y.**

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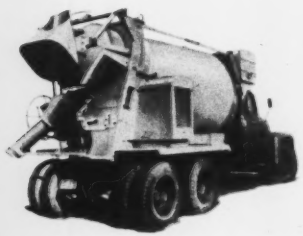
Equipment, Materials & Methods (Continued)

Dual Purpose Valve

THE 125 LB CAST iron valve, No. 818, consists of a 12 in. beveled vane which seats against the body side wall with a 4 in. vane mounted in the center of the larger vane—really a valve within a valve. It is employed in a turbine bypass line for controlling the required quantity of water when the turbine is not in use or when it is operating at reduced capacity. Valve is equipped with 18-8 shafts, bronze bushings, and two lubricated stuffing boxes with two outboard bearings. Both vanes are motor operated. Designed for either a high pressure drop and small volume or a low pressure drop and large volume, this type valve is frequently furnished with a small free revolving vane. Available in various combinations of sizes and for elevated or sub-zero temperatures, either manual or automatic control. **R-S Products Corporation, a S. Morgan Smith Co. subsidiary, 4600 Germantown Ave., Philadelphia 44, Pa.**

Transit Mixer

THE 5½ YD Hi-Discharge Moto-Mixer, now being produced along with a 7 yd moto-mixer, is announced. The outstanding and exclusive features "built in" to these machines are numerous. The machine is scientifically designed with the invaluable aid of the new electronic strain



5½ Yd Mixer

gauge method which measures electronically and records graphically the stresses produced in every part of the machine when operating under actual conditions. Drive and transmission is placed under the drum in the rear, making possible lower and easier maintenance—much easier inspection and adjustment. The position of the water tank over cab and drum against back of cab gives better weight distribution. This makes possible the greatest legal pay-load on any given truck. Also available with these units is a rear-end closure door which eliminates spilling of concrete and replaces the discharge-door seal. **Chain Belt Company, 1600 W. Bruce St., Milwaukee 4, Wis.**

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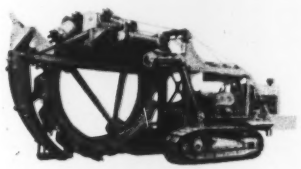
Equipment, Materials & Methods (Continued)

Electrodes

A LINE OF HARD-FACING electrodes and acetylene welding rods is announced. The line is in step with an increasing interest in hard-facing. Hard-facing will become more and more important as basic materials become tighter in supply. The electrodes, recently added to the Murex line, include rods for extreme abrasion, medium and heavy impact, severe shock, high red hardness, and extreme heat and corrosion resistance. In addition, there is a tungsten carbide rod which provides an exceptionally slag free deposit, allowing all residue to be readily cleaned away by wire brushing. **Metal & Thermit Corp., 100 East 42nd St., New York 17, N. Y.**

Trenchliners

FULL SCALE PRODUCTION has been started on two models of Trenchliners. Both are full crawler-mounted, wheel-type machines. Model 202 is designed primarily for drainage and utility trenching. Model 215 is a special pipeline Trenchliner.



Model 202

With a choice of either 52 hp gasoline or 55 hp diesel engine, the Model 202 is equipped to dig in 30 separate feeds from 6.2 in. to 18.5 ft per min; and in 9 widths from 13 to 31 in. wide and up to 6 ft deep. Other features include: friction clutch control of digging wheel, easily changed bucket fronts with cutting lips or "Tap-In" teeth, shiftable and reversible belt conveyor for discharging spoil on either side of machine. Full crawler mounted, with either 16 or 20 in. treads, the Model 202 Trenchliner has only 5 to 6 lbs per square inch ground bearing pressure. This is particularly important on drainage, irrigation, municipal and utility-type projects for which the machine is particularly designed. For laying drainage tile, a special box and chute are available as optional equipment. The Model 215 has several outstanding features designed for "mile-a-day" production on cross-country pipeline installations: 6 digging wheel speeds up to 11.2 rpm, standard-make tractor type crawlers with lug-type shoes, 18 in. treads, and choice of two standard-make 55 hp diesel engines. **Parsons Company, a subsidiary of the Koehring Company, Newton, Iowa**

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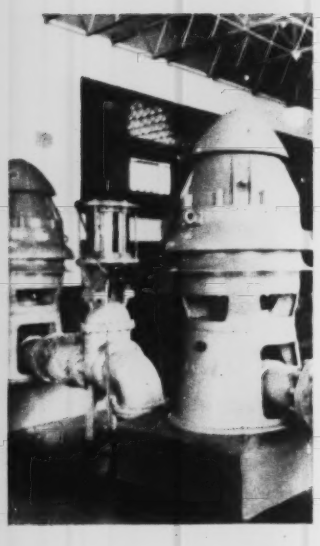

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Equipment, Materials & Methods (Continued)

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Square Saw Blade

A COMPLETE LINE of square blades, has been introduced. Operating on an entirely new cutting principle, the blade, known as the squared circle saw blade, handles all types of cross cutting and rip sawing faster than the conventional type circular saw blade. The saw blade is actually a square with a series of scientifically designed teeth located at each corner of the square. The absence of teeth along the sides of the square means that there is very little friction during the cutting operation. This results in a cooler cutting blade and virtually eliminates the problem of burned out blades or motors. The saw blade requires considerably less power to operate. Other advantages include fewer teeth to sharpen and set which results in fewer upkeep. **Clark & Sawyer, Inc., 602 Mateo St., Los Angeles 21, Calif.**

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HEAVY BUILDING TIMBERS can now be cut faster, easier and more accurately with an electric hand chain saw. The Model 11E18 "smooth cut" chain saw is designed for cutting structural timbers too large for circular power saws, that must be ordinarily sawed or chipped by tedious hand methods. The thin chain guide and narrow, special toothed chain, produces extremely smooth and precise finish cuts for jointing beams and architectural supports of all kinds. Weighing under 20 lbs, it's light enough for one hand use. A helpers handle can also be attached so two men may saw sharp angles for fittings with ease in one swift operation. It has an 18 in. cutting bar. Models are available for either 115 or 230 volt AC DC current. Operates very efficiently off a portable generator, and can be run over 200 ft, from its power source with extension cords. **Mall Tool Company, 7725 South Chicago Ave., Chicago 19, Ill.**

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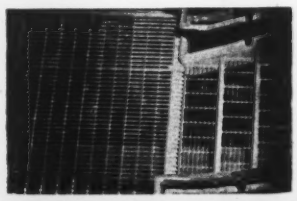

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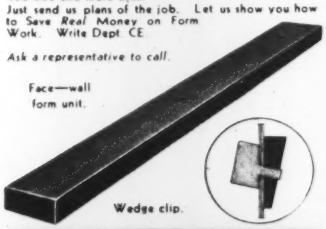

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Literature Available

DIESEL TRACTOR—The subject of the catalog is a 32 drawbar horsepower machine with many applications in agriculture, construction, logging, mining and other fields. Part by part the catalog explains how the machine is built, what it's like and how it performs. Typical jobs are shown, along with reports from actual D2 tractor owners. More than 60 pictures are included in the 32 page booklet presentation. Ask for Form No. 30284. **Caterpillar Tractor Co., Peoria, Ill.**

HYDROCRANE—"Busy As A Bee" is the title of a recent publication describing the all-hydraulic Hydrocrane. The two-color, 24-page booklet pictorially illustrates the machine's versatility by showing it doing everything from digging ditches to moving furniture through second story windows. The more than 100 illustrations show the machine with its many attachments placing tanks and pipe; digging, trenching and backfilling; hoisting and erecting; loading, unloading and stock piling; cleaning catchbasins, removing snow and stumps and cleaning up in quarries, mines and public streets. **Bucyrus-Erie Company, South Milwaukee, Wis.**

DIESEL ENGINES—A 12 page, two color bulletin illustrates and describes the design and operation features of the Nordberg one, two and recently introduced three cylinder Type 4FS diesel engines. Bulletin 194 contains pictures showing all main engine parts and complete engine specifications. It also describes the low fuel consumption, full pressure lubrication, efficient cooling systems, electric and manual starting equipment and other features of the 4FS diesel engines. **Nordberg Manufacturing Co., Milwaukee 1, Wis.**

FREE DISCHARGE VALVE—A 16 page color illustrated bulletin No. 156 features the Howell Bunger free discharge valve for high and low heads. The chief advantage of the valve is the prevention of "pot holes" in the bed of a stream since the water is discharged in the form of a fine spray. Other advantages are explained in detail. Bulletin contains a cutaway view, numerous illustrations of the valve in action, detailed specifications and shop views. **S. Morgan Smith Company, York, Pa.**

CENTRIFUGAL BLOWERS—Construction features of multi-stage Type V centrifugal blowers for equivalent air pressures above 6.5 psi and inlet volumes above 1500 cfm are described in Bulletin No. 19B6104A. Illustrations include a complete cross-section of a multi-stage Type V gas exhauster, photographs of components of multi-stage Type V blowers, of two-stage, three-stage and four-stage blowers with the tops of their casings removed, and of typical installations in a variety of industries. **Allis-Chalmers Manufacturing Company, 1187 S. 70th St., Milwaukee, Wis.**

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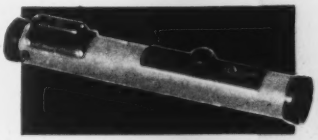

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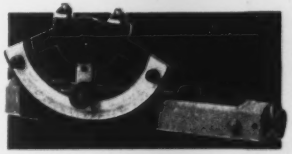

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Literature Available (Continued)

PRODUCT CATALOG.—A 4 page illustrated bulletin entitled "Power-thrifty Products by Phillie Gear" is offered. It shows a line of gears, speed reducers, flexible couplings and limi-torque valve controls. Types and size ranges are given. **Philadelphia Gear Works, Inc., Erie Ave. & G St., Philadelphia 34, Pa.**

GENERAL PURPOSE PUMPS.—Construction details on grease-lubricated pedestal-mounted general purpose pumps, Type SSB, are given in a bulletin just released. The pumps, available in capacities to 2500 gpm at heads to 550 ft, can be had with stuffing box or mechanical seal, direct coupling or V-belt drive, and in a choice of materials. **Allis-Chalmers Manufacturing Co., 1187 S. 70th St. Milwaukee 1, Wis.**

COMPANY'S SERVICES.—A 4-page folder just published, describes the engineering services offered by the company. These services include the design of buildings, foundations, and equipment for industrial plants, as well as project coordination and control. **York Engineering & Construction Company, 951 Penn Avenue, Pittsburgh 22, Pa.**

CONVEYOR AND ELEVATOR BELTING.—A catalog on conveyor and elevator belting which gives all the necessary data to lay out a drive or specify a belt has been published. Complete tables on carrying capacities, horsepower factors, pulley diameters, maximum and minimum plies for proper troughing and other engineering information are included. **New York Belting and Packing Co., 1 Market St., Passaic, N. J.**

EARTH DRILL.—A folder describing the features of the Model 150 A earth drill, has been issued. Pictures, sketches and diagrams show the operation of this mechanical drilling machine as it digs caisson pier holes, pre-bores concrete piles, drills water wells and cesspools, explores mineral deposits and tests soil conditions. Text gives specifications and explains the various usages of the Calweld earth drill in heavy duty construction, mining and oil field work. **The California Welding and Blacksmith Shop, Inc., Los Angeles, Calif.**

LUBRICATED PLUG VALVE.—A fully descriptive catalog covering an entire line of lubricated plug valves is now available. By means of cross section and cut-away illustrations as well as line drawings the unusual features of this modern design valve are presented. Information on working pressures, materials of construction, design and function, manufacturing methods, accessories, lubricants, and pressure and temperature ratings is also included. Write to **P. J. Gallagher, Porter Valve Div., H. K. Porter Co., Inc., 1150 North Peoria St., Tulsa 1, Okla.**

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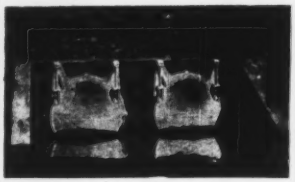

Fig. B-124-D
Two 60" Type M Gates on Relief Culverts near Woodward Pumping Station, Plymouth, Pa.

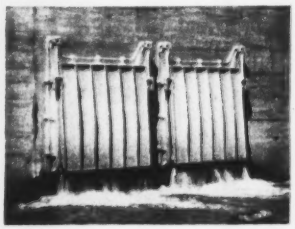

Fig. B-124-C
Two 72" x 72" Type M-M Gates on Toby Creek Outlet Works, Plymouth, Pa.

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Summarized in Earlier Issues

D-36. Discussion of Paper, **Impossibility of Performance in Contracts for Engineering and Construction**, by Robert F. Borg.

D-39. Discussion of Paper, **Practical Design of Solid-Barrel Reinforced-Concrete Skew Structures**, by Bernard L. Weiner.

D-42. Discussion of Paper, **Wind-Load Standards in Europe**, by John W. T. Van Erp.

D-43. Discussion of Paper, **Settlement Correction at La Guardia Field**, by John M. Kyle.

D-44. Discussion of Paper, **The Problem of Wave Action on Earth Slopes**, by Martin A. Mason.

97. **Consumptive Use in the Rio Grande Basin**, by Robert L. Lowry.

98. **Consumptive Use of Water on Irrigated Land**, by Wayne D. Criddle.

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100. **Forced Vibrations of Continuous Beams**, by Edward Saibel and Elio D'Appolonia.

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103. **Pile Foundations for Large Towers on Permafrost**, by L. A. Nees.

104. **Redesign of Major Airport Terminals**, by Herbert H. Howell.

105. **Principles of Highway Capacity Research**, by O. K. Normann.

D-37. Discussion of Paper, **Design of Prestressed Tanks**, by J. M. Crom.

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106. **Analysis of Ground Water Lowering Adjacent to Open Water**, by Stuart B. Avery, Jr.

107. **Characteristics of the Solitary Wave**, by James W. Daily and Samuel C. Stephan, Jr.

108. **Control of Embankment Material by Laboratory Testing**, by F. C. Walker and W. G. Holtz.

109. **Final Foundation Treatment at Hoover Dam**, by A. Warren Simonds.

110. **Review of Flood Frequency Methods**, final report of the Subcommittee of the ASCE Joint Division Committee on Flood8.

111. **Research in Water Spreading**, by Dean C. Muckel.

D-49. Discussion of Paper, **Large Hyperbolic Functions Computed by Fission**, by F. T. Llewellyn.

D-54. Discussion of Paper, **Truss Deflections by the Coordinate Method**, by Kuang-Han Chu. In Proceedings-Separate No. 54.

D-61. Discussion of Paper, **Structural Damping in Suspension Bridges**, by the late Friedrich Bleich and L. W. Teller.

Third Notice

112. **Diversions from Alluvial Streams**, by C. P. Lindner.

113. **Wave Forces on Breakwaters**, by Robert Y. Hudson.

114. **Utilization of Underground Storage Reservoirs**, by Harvey O. Banks.

D-51. Discussion of Paper, **Laterally Loaded Plane Structures and Structures Curved in Space**, by Frank Baron and James P. Machaba.

D-57. Discussion of Paper, **Design of Irrigation Systems**, by W. H. Nalder.

D-60. Discussion of Paper, **Surveying and Mapping Requirements for Modern City Planning**, by Charles A. Blessing.

D-62. Discussion of Paper, **The New Towns Program in Great Britain**, by T. C. Coote.

Second Notice

115. **Lake Michigan Erosion Studies**, by John R. Hardin and William H. Booth, Jr. Erosion problems along the Illinois shore of Lake Michigan are analyzed in this paper. The reach described has been divided into four sections and the solution of the problems peculiar to each section has been recommended. Protective structures such as groins, submerged breakwaters, piers, and artificial fills are described and their effectiveness in correcting and preventing future shore erosion are evaluated. The proposed solutions discussed call for gradual building of new beaches to provide protection of the shore line as well as development of recreational facilities for the neighboring population. (Available March 1.)

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116. **Graphical Solution of Hydraulic Problems,** by Kenneth E. Sorensen. A general method of graphical integration of differential equations is described and the method is applied to specific hydraulic problems. Examples are given for solution of problems of reservoir flood routing, backwater curves in channels, and surge-tank water-level variations. The method is claimed to be an improvement over those now in use in that trial-and-error computations are eliminated, less time is required for solutions, and checking is greatly facilitated. (Available March 1.)

117. **Development of Stresses in Shasta Dam,** by Jerome M. Raphael. During the construction of Shasta Dam, strain meters and other instruments are imbedded in the concrete. The results of long-term observations of the stresses found at the base of the spillway section of the dam is presented in this paper. An attempt is made to draw conclusions regarding the behavior of gravity dams in general from observations of the structural behavior of Shasta in the period since its construction in 1940. (Available March 1.)

118. **Flocculation Phenomena in Turbid Water Clarification,** by Harvey F. Ludwig, W. F. Langelier, and Russel G. Ludwig. Synthetic turbid waters mixed for these experiments were made by suspending clay in water, in the presence of varying amounts and types of alkalinity. The clay particles had varying ion exchange capacities and varying particle coagulants. Various interfering substances were added during the experiments, including sequestering and surface active agents. A comprehensive theory of flocculations is developed which represents the attainment of a complex equilibrium in which many variables are involved, including turbidity, particle-size distribution, exchange capacity, pH, and alkalinity. (Available April 1.)

D-39. Discussion of Paper, **Limit Design of Beams and Frames,** by H. J. Greenberg and W. Prager. Statically indeterminate beams or frames were analyzed by limit design, in this paper, published in February, 1951. Discussers are: L. E. Grinter, I. K. Silverman, J. Benjamin, E. P. Popov, A. Hrennikoff, P. S. Symonds, H. Tachu, V. Francioni, and H. J. Greenberg and W. Prager. (Available April 1.)

D-56. Discussion of paper, **Turbulent Transfer Mechanism and Suspended Sediment in Closed Channels,** by Hassan M. Ismail. The effect of sand in suspension on the universal constant of turbulent exchange, distribution of momentum transfer coefficient and the coefficient of friction, are described in this paper published in February, 1951. Discussers are: Emmett M. Laursen, M. R. Carstens, and Hassan M. Ismail. (Available March 1.)

D-70. Discussion of **Regime Theory for Self-Formed Sediment-Bearing Channels,** by J. Blench. Rational formulas are developed in the paper (May, 1951), for rivers in India, under conditions of sediment-laden water, excavated canal boundaries or erodible alluvium, and very flat country. Discussers are: Emmett M. Laursen, Gerard H. Matthes, and J. Blench. (Available March 1.)

First Notice

119. **Thin-Walled in Combined Torsion and Flexures,** by Warner Lansing. The performance of thin-walled open section bars subjected to eccentric transverse loads is analyzed by Goodier's bar theory. Calculations are made covering the range of commercially available cold formed sheet steel channels and Z sections for transverse loads in the plane of the web. The results indicate that certain quantities including the torsional rigidity may be neglected in most cases with good accuracy. A comparison with tests shows reasonable agreement, and design procedures for braced channels have been suggested in agreement with this work. (Available April 1.)

120. **Surface Water Wave Theories,** by Martin A. Mason. This paper presents for the first time in engineering literature a summary of the information required by engineers to solve problems involving ordinary wave action on structures, such as dams, submerged pipe lines, piles, breakwaters, and jetties. Transportation of material by waves is discussed and methods of predicting wave action are presented. Many formulas, charts, and graphs prepared for the use of practicing engineers are included. An extensive selected bibliography is supplied for the use of those requiring more detailed information. (Available April 1.)

121. **Rate of Change of Grade per Station,** by Clarence J. Brownell. The purpose of this paper is to urge the adoption of a method of describing vertical curves which will give an immediate impression of the sharpness of such a curve. The method explained herein provides a convenient tool for the solution of problems in vertical alinement that can otherwise be determined by trial and error. In the coming era of divided highways and on-and-off ramps, this tool will be found most convenient. (Available April 1.)

122. **Engineering Aspects of Diffraction and Refraction,** by J. W. Johnson. The design, construction, and operation of many coastal engineering works is considerably dependent on the principles of wave refraction and diffraction. This paper discusses the principles that enable the engineer to estimate the "design" wave conditions at specified points on a shoreline. The phenomena of refraction and diffraction are discussed in connection with practical solution of shoreline problems. (Available April 1.)

D-68. Discussion of paper, **National Topographic Mapping,** by W. E. Wrather. The original paper, published in April, 1951, explained the cooperation of the Geological Survey and federal and state agencies to expediate progress on the national topographic mapping program. Discussers are: Milton O. Schmidt, O. P. Krynine, and W. E. Wrather. (Available April 1.)

D-71. Discussion of Paper, **Rectification of the Papaloapan River in Mexico,** by Reynaldo Schega. The original paper, published in May, 1951, deals with the building of river cutoffs, as forming the initial steps leading to the relief of the lands bordering the Papaloapan River. Discussers are: Leo M. Odom, Samuel Shulits, and Reynaldo Schega. (Available April 1.)

D-53. Discussion of Paper, **Wedge-Beam Framing,** by Arsham Amirikian. The original paper, published in January 1951, suggested arrangements of wedge-beam framing are outlined, the range of application is discussed, and a method of analysis is presented. Formulas and tables, as well as a simplified procedure of solution of simultaneous equations, are also given to facilitate the necessary computations in practice. Discussers are: G. C. Ernst, J. J. Hromadik, G. R. Swihart, Herbert A. Sawyer, Jr., J. J. Polivka, and Arsham Amirikian. (Available May 1.)

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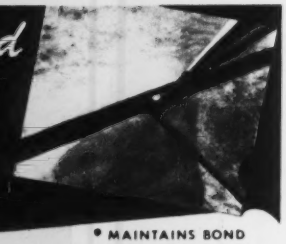

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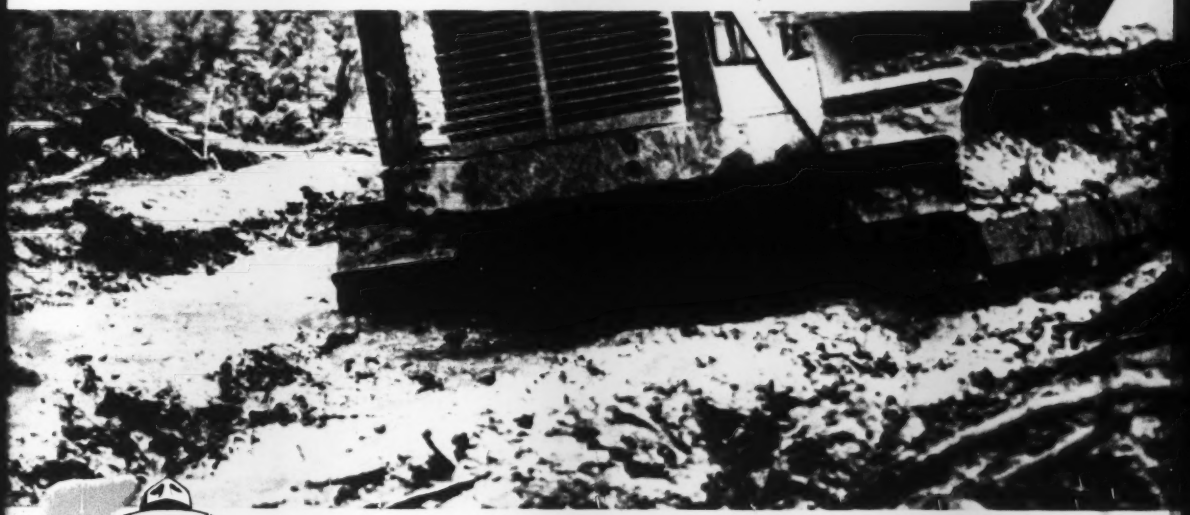

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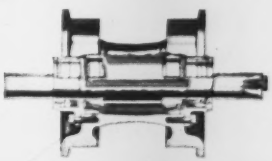

Tapered Roller Bearings protect the Positive Seals by letting truck wheels, idlers and support rollers rotate freely . . . without side thrust or wobble.

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SCOPE OF SERVICES—*Lock Joint Pipe Company specializes in the manufacture and installation of Reinforced Concrete Pressure Pipe for Water Supply Distribution Mains in a wide range of diameters as well as Concrete Pipes of all types for Sanitary Sewers, Storm Drains, Culverts and Subaqueous Lines.*

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